TETER, Inc.
ARCHITECTS ENGINEERS CONNECTED

PROJECT MANUAL

CONTRACTUAL – LEGAL REQUIREMENTS
TECHNICAL SPECIFICATIONS

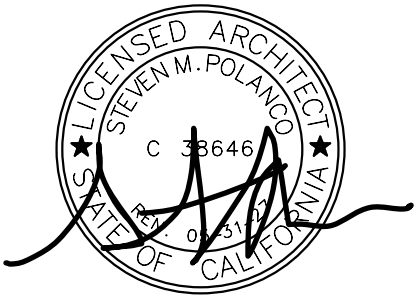
FOR

COLLEGE OF THE SEQUOIAS
STUDENT UNION BUILDING
VISALIA CAMPUS

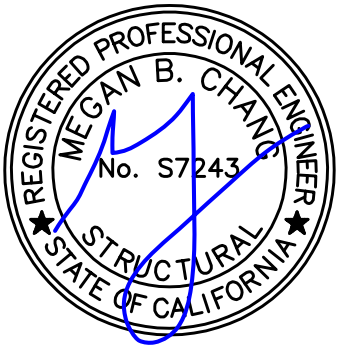
Project No.: 22-12499
District Bid No.:
DSA File No.: 54-C2
DSA Appl. No.: 02-123516

TETER | 7535 N. Palm Avenue, Ste. 201 | Fresno, California 93711 | 559.437.0887 T | 559.438.7554 F | www.teterae.com

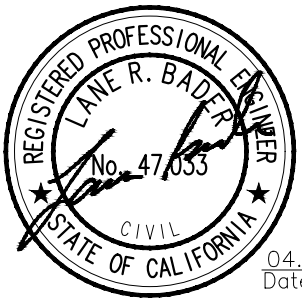
SECTION 000107
SEALS PAGE



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COS VISALIA CAMPUS
STUDENT UNION

September 23, 2026

COLLEGE OF THE SEQUOIAS
SEQUOIAS COMMUNITY COLLEGE DISTRICT

PROJECT MANUAL
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NOTICE TO BIDDERS

DISTRICT	Sequoias Community College District
PROJECT NAME	**COS Student Union**
PROJECT DESCRIPTION	The project consists of construction of a 39,000 s.f., 2-story Student Services/Support Facility with commercial kitchens, dining, student support program offices, demolition of the existing "Alta Peak" food services, and related site infrastructure and improvements.
BID PROPOSALS DUE DATE / TIME	**Tuesday, October 27th, 2026 @ 2:00 p.m.** Bid opening will occur immediately following receipt of responsive bids.
LOCATION FOR SUBMISSION OF BID PROPOSALS	College of the Sequoias – Visalia Campus Sequoia Building – Room 1 (Admin Wing) 915 S. Mooney Blvd. Visalia, California 93277 **Parking permit required to park on District property and may be purchased on site. Please plan accordingly.** *Bids submitted in advance of due date are to be delivered to:* *College of the Sequoias – Visalia Campus* *Facilities Office (Blue Oak Building – Room 901)* *Attn: Byron Woods* *915 S. Mooney Blvd.* *Visalia, CA 93277*
LOCATION FOR OBTAINING BID AND CONTRACT DOCUMENTS	TETER, Inc. To obtain the drawings and specifications, which will only be issued electronically, bidders shall contact TETER, Inc, Attn: kristina.antuna@teterae.com.

NOTICE IS HEREBY GIVEN that the above-named California Community College District, acting by and through its Board of Trustees, hereinafter the "District" will receive up to, but not later than the above-stated date and time, sealed Bid Proposals for the Contract for the Work of the Project generally described as the **COS Student Union**. The project consists of construction of a 39,000 s.f., 2-story Student Services/Support Facility with commercial kitchens, dining, student support program offices, demolition of the existing "Alta Peak" food services, and related site infrastructure and improvements. Work shall be completed within **820 calendar days** - see Project Manual (Special Conditions, Article 8. Milestones) for Project phasing, schedule restrictions and requirements. **The estimate construction budget is Thirty-two Million Dollars ($32,000,000).**

Submittal of Bid Proposals. All Bid Proposals shall be submitted on forms furnished by the District. Bid Proposals must conform with, and be responsive to, the Bid and Contract Documents, copies of which may be obtained from the District as set forth above. Only Bid Proposals submitted to the District at or prior to the date and time set forth above for the public opening and reading of Bid Proposals shall be considered. Upon submittal of such Bid Proposal, neither withdrawal nor modifications to any portion of the Bid Proposal shall be permitted, unless written request for withdrawal or modification is received by the District prior to the due date and time for submission of Bid Proposals.

Bid and Contract Documents. The Bid and Contract Documents are available at the location identified above beginning **September 24, 2026**. There are no fees to access the FTP Site and the Contractor will be able to download the Project Documents. All associated printing costs will be the responsibility of the Contractor. Hard copies of the Project Documents will not be made available or provided during the bid period nor will they be made available or provided to the awarded Contractor. It is the Contractors responsibility to check the FTP Site during the bid period as all revisions/updates will be posted there.

Documents Accompanying Bid Proposal. Each Bid Proposal shall be accompanied by: (a) the required Bid Security; (b) Subcontractors List; (c) Non-Collusion Affidavit; (d) Contractor's Certificate Regarding Workers' Compensation; (e) Prevailing Wage Compliance Certification; (f) Verification of Contractor and Subcontractors' DIR Registration; and (g) Fleet Compliance Certification. The successful bidder shall also be required to enter into a written Agreement on a form provided by the District. All information or responses of a Bidder in its Bid Proposal and other documents accompanying the Bid Proposal shall be complete, accurate and true; incomplete, inaccurate or untrue responses or information provided therein by a Bidder shall be grounds for the District to reject such Bidder's Bid Proposal for non-responsiveness.

Prevailing Wage Rates. Pursuant to California Labor Code §1773, the Director of the Department of Industrial Relations of the State of California has determined the generally Prevailing Wage Rates in the locality in which the Work is to be performed. The Contractor and all Subcontractors performing any portion of the Work shall pay not less than the applicable PWRs for the classification of labor provided by their respective workers in the execution of the Work. Pursuant to California Labor Code §1771.4(a)(4), PWR monitoring and enforcement shall be by the Department of Industrial Relations.

DIR Registration Verification. Each Bidder submitting a proposal to complete the Work, labor, materials and/or services subject to this procurement, must be a Department of Industrial Relations (DIR) registered contractor pursuant to Labor Code §1725.5 ("DIR Registered Contractor"). A Bidder who is not a DIR Registered Contractor when submitting a proposal for the Work is deemed "not qualified" and the proposal of such a Bidder will be rejected for non-responsiveness. Pursuant to Labor Code §1725.5, all Subcontractors identified in a Bidder's Subcontractors' List shall be DIR Registered Contractors. If awarded the Contract for the Work, at all times during performance of the Work, the Bidder and all Subcontractors, of any tier, shall be DIR Registered Contractors.

Contractor's License Classification. In accordance with the provisions of California Public Contract Code §3300, the District requires that Bidders possess, at the time of submission of a Bid

Proposal, at the time of award of a Contract for a Bid Package, and at all times during the Work, the classification(s) of a California Contractors License for each Bid Package as set forth below. Any Bidder not so duly and properly licensed shall be subject to all penalties imposed by law. No payment shall be made for work, labor, materials or services provided under the Contract for the Work until the Registrar of Contractors verifies to the District that the Bidder awarded the Contract is properly and duly licensed to perform the Work. **Prospective Bidders shall be required to have a valid class "B" Contractor's License.**

District Standards. In accordance with California Public Contract Code §3400, a designee of the District has made a finding that particular materials, products, things, and/or services are to be designated in the Contract Documents by specific brand or trade name for the following purpose: in order to match other products in use on a particular public improvement either completed or in the course of completion ("District Standards"). The District Standards may be designated elsewhere in the Contract Documents.

Bid Security. Bids must be accompanied by a bidder's bond or certified check for at least ten percent (10%) of the amount of the bid and payable to the District, which shall be given as a guarantee that the Bidder will enter into a contract if awarded the Work. Said bond or certified check will be declared forfeited, paid to, or retained by the District as Liquidated Damages if the Bidder refuses or neglects to enter into the Contract provided by the District.

Pre-Bid Conference. A mandatory job walk will be conducted on Thursday, October 1st, 2026 at 11:00 a.m. at the College of the Sequoias Visalia campus (915 S. Mooney Blvd., Visalia, CA 93277). Interested bidders shall meet in front of the Facilities Office (Blue Oak Building – Room 901). It is the Bidder's sole responsibility to understand the Work and existing site conditions prior to submittal of any Bid Proposals. Parking permits are strictly enforced at all COS campuses. Please plan accordingly.

Waiver of Irregularities. The Board of Trustees reserves the right to reject any or all proposals, waive any informality in the receiving of bids, and consider quality, convenience, and reasonable qualifications, as well as price, in making awards.

Refer questions regarding this bid to: Kristina Antuna, Teter Architects and Engineers, kristina.antuna@teterae.com. **Last day to submit questions is October 20th, 2026.**

SEQUOIAS COMMUNITY COLLEGE DISTRICT

PUBLISHED: **September 25, 2026 & September 29, 2026**

INSTRUCTIONS TO BIDDERS
PROJECTS INVOLVING LABOR

No Bid Proposals shall receive consideration by the Sequoias Community College District unless made in accordance with the following instructions:

1. Preparation and Submittal of Bid Proposal.

1.1. Bid Proposal Forms. Bid proposals must be made on a form obtained from the District. All information required by the bid forms must be completely and accurately provided. Numbers shall be stated in both words and figures where so indicated in the bid forms; conflicts between a number stated in words and in figures are governed by the words. Signatures of all individuals must be in long-hand form. If any Bid Proposal or portions thereof, is determined by the District to be illegible, ambiguous or inconsistent, whether by virtue of any erasures, interlineations, corrections or otherwise, the District may reject such a Bid Proposal as being non-responsive. Partially completed Bid Proposals or Bid Proposals submitted on other than the bid forms included herein are non-responsive and will be rejected. Bid Proposals not conforming to these Instructions to Bidders and the Notice to Bidders may be deemed non-responsive and rejected. Each bid must have the full business address of the Bidder and must be signed by the Bidder with his or her usual signature. Bids by partnership must furnish the full names of all partners and must be signed in the partnership name by a general partner with authority to bind the partnership in such matter. Bids by corporations must be signed with the legal name of the corporation, followed by the signature and designation of the president, secretary, or other person authorized to bind the corporation in this matter. The name of each person signing shall also be typed or printed below the signature. When requested by the District, satisfactory evidence of the authority of the officer signing on behalf of the corporation shall be furnished. A Bidder's failure to properly sign required forms may result in rejection of the bid.

1.2. Bid Proposal Submittal. Bid Proposals shall be submitted at the place designated in the Notice to Bidders, in sealed envelopes bearing on the outside the Bidder's name and address, along with the Project Name for which the Bid Proposal is submitted. Bidders are solely responsible for timely submission of Bid Proposals to the District at the place designated in the Notice to Bidders.

Date and Time of Bid Proposal Submittal. Bid Proposals must be sealed and submitted to the **Sequoia Building – Room 1 (Admin Wing) 915 S. Mooney Blvd. Visalia, California 93277,** no later than the hour and date specified in the Notice to Bidders. The District recommends that bids be hand delivered in order to insure their timely receipt. **Parking permit required to park on District property and may be purchased on site. Please plan accordingly.**

1.3. Withdrawal of Bid Proposal. Bid Proposals may be withdrawn by a Bidder prior to the time fixed for the opening of bids, but may not be withdrawn for a period of forty-five (45) days after the opening of bids. A successful bidder shall not be relieved of the bid submitted without the District's consent or Bidder's recourse to Public Contract Code §5100 et. seq.

2. Pre-Bid Conference. A mandatory job walk will be conducted on Thursday, October 1st, 2026 at 11:00 a.m. at the College of the Sequoias Visalia campus (915 S. Mooney Blvd., Visalia, CA 93277). Interested bidders shall meet in front of the Facilities Office (Blue Oak Building – Room 901). It is the Bidder's sole responsibility to understand the Work and existing site conditions prior to submittal of any Bid Proposals. Parking permits are strictly enforced at all COS campuses. Please plan accordingly. Currently there are no COVID protocols for the Pre-bid Conference. Social distancing is encouraged at all times. COVID safety requirements are subject to change.

3. Pre-Bid Request for Information or Clarification. Any questions regarding this bid shall be directed to: Kristina Antuna, Teter Architects and Engineers, kristina.antuna@teterae.com. **Last day to submit questions is October 20th, 2026**

4. Documents Accompanying Bid Proposal; Signatures. The Bid Proposal must be submitted with: (a) the required Bid Security; (b) Subcontractors List; (c) Non-Collusion Affidavit; (d) Contractor's Certificate Regarding Workers' Compensation; (e) Prevailing Wage Compliance Certification; and (f) Verification of Contractor and Subcontractors' DIR Registration. The Bid Proposal and Non-Collusion Affidavit shall be executed by an individual duly authorized to execute the same on behalf of the Bidder.

5. Bid Security.

5.1. Required Bid Security. Bid Proposals should be accompanied by a certified cashier's check or bidder's bond from an admitted surety in the state of California (see Public Contract Code Article 41, §20651.5), for an amount not less than ten percent (10%) of the maximum amount of the Bid Proposal for the Work, inclusive of any additive Alternate Bid Item(s). The cashier's check or bidder's bond shall be made payable to the order of: Sequoias Community College District. The Bid Bond is due at the same date and time as the Bid Proposal and the bond shall be given as a guarantee that the Bidder will enter into the Contract if awarded the Work. Any Bid Proposal submitted without the required Bid Security is deemed non-responsive and will be rejected. If the Bid Security is in the form of a Bid Bond, the Bidder's Bid Proposal shall be deemed responsive only if the Bid Bond is in the form and content included herein and the Surety is an Admitted Surety Insurer under Code of Civil Procedure §995.120.

5.2. Bid Bond Original Signatures. Notwithstanding provisions of the documents for the Work requiring that a Bid Bond submitted by a Bidder to meet Bid Security requirements must bear original signatures of the Bidder and the Attorney-In-Fact for the Surety issuing the Bid Bond, a Bid Proposal will not be rejected for non-responsiveness if it is submitted with a facsimile signature of the Surety's Attorney-

In-Fact and the Bidder submits a copy of the Bid Bond bearing the original signature of the Surety's Attorney-In-Fact to the District not later than 4:00 P.M. the third (3rd) working day after the date Bid Proposals for the Work are publicly opened. The copy of the Bid Bond bearing the original signature of the Surety's Attorney-In-Fact must be delivered to the **College of the Sequoias, Facilities Office (Blue Oak Building), 915 S. Mooney Blvd., Visalia, CA 93277** prior to the date/time set forth above. A Bid Proposal submitted with a Bid Bond bearing the facsimile signature of the Surety's Attorney-In-Fact without timely submittal of the original signature of the Surety's Attorney-In-Fact pursuant to the foregoing will be rejected for non-responsiveness.

5.3. Forfeiture of Bid Security. If the Bidder awarded the Contract fails or refuses to execute the Agreement within ten (10) calendar days from the date of receiving notification that it is the Bidder to whom the Contract has been awarded, the District may declare the Bidder's Bid Security forfeited as damages caused by the failure of the Bidder to enter into the Contract and may thereupon award the Contract for the Work to the responsible Bidder submitting the next lowest priced Bid Proposal or may call for new bids, in its sole and exclusive discretion.

5.4. Bid Security Return. The Bid Security of three or more low Bidders, the number being solely at the discretion of the District, will be held by the District for ten (10) days after the period for which Bid Proposals must be held open (which is set forth in the Notice to Bidders) or until posting by the successful Bidder(s) of the bonds, certificates of insurance required and return of executed copies of the Agreement, whichever first occurs, at which time the Bid Security of such other Bidders will be returned to them.

6. Subcontractors.

6.1. Designation of Subcontractors; Subcontractors List. In accordance with Public Contract Code §4104, the Subletting and Subcontracting Fair Practices Act (California Public Contract Code §4100 et seq.), each Bidder shall submit, on the form of Subcontractors List included with the Contract Documents, a list of its proposed Subcontractors for the proposed Work who will perform/provide portions of the Work valued at or more than one-half (1/2) of one percent (1%) of the amount proposed by the Bidder for the Work. Each Bidder's shall provide the "Kind of Work", "Company Name and Address", "DIR Registration #" and "License #" for each Subcontractor identified in the Bidder's Subcontractor List. If the portion of the Subcontractors List entitled "License #" is not completed on the form of Subcontractors List submitted by a Bidder concurrently with its Bid Proposal, such Bidder shall, not later than twenty-four (24) hours after the time when the District commences the public opening and reading of Bid Proposals, submit the Subcontractor's Contract License No. for each listed Subcontractor. Failure of a Bidder to provide all information required by the Subcontractors List within the time(s) set forth above will result in rejection of the Bidder's Bid Proposal for non-responsiveness.

6.2. Work of Subcontractors. All Bidders are referred to the Contract Documents and the notation therein that all Contract Documents are intended to be complementary and

that the organization or arrangements of the Specifications and Drawings shall not limit the extent of the Work of the Contract Documents. Accordingly, all Bidders are encouraged to disseminate all of the Specifications, Drawings and other Contract Documents to all persons or entities submitting sub- bids to the Bidder. The omission of any portion or item of Work from the Bid Proposal or from the sub-bidders' sub-bids which is/are necessary to produce the intended results and/or which are reasonably inferable from the Contract Documents is not a basis for adjustment of the Contract Price or the Contract Time. Dissemination of the Contract Documents to sub-bidders and dissemination of addenda issued during the bidding process is solely the responsibility of each Bidder.

6.3. Subcontractor Bonds. In accordance with California Public Contract Code §4108, if a Bidder requires a bond or bonds of its Subcontractor(s), whether the expense of procuring such bond or bonds are to be borne by the Bidder or the Subcontractor(s), such requirements shall be specified in the Bidder's written or published request for sub-bids. Failure of the Bidder to comply with these requirements shall preclude the Bidder from imposing bonding requirements upon its Subcontractor(s) or rejection of a Subcontractor's bid under California Public Contract Code §4108(b).

7. Bidders Interested in More Than One Bid Proposal: Non-Collusion Affidavit. No person, firm, corporation, or other entity shall submit or be interested in more than one Bid Proposal for the same Work; provided, however, that a person, firm or corporation that has submitted a sub-proposal to a Bidder or who has quoted prices for materials to a Bidder is not thereby disqualified from submitting a sub-proposal, quoting prices to other Bidders or submitting a Bid Proposal for the proposed Work to the District. The form of Non-Collusion Affidavit included in the Contract Documents must be completed and duly executed on behalf of the Bidder. Failure of a Bidder to submit a completed and executed Non-Collusion Affidavit with its Bid Proposal will render the Bid Proposal non-responsive.

8. Workers' Compensation Insurance. Pursuant to California Labor Code §3700, the successful Bidder shall secure Workers Compensation Insurance for its employees engaged in the Work of the Contract. The successful Bidder shall sign and deliver to the District the following certificate prior to performing any of the Work under the Contract:

> "I am aware of the provisions of §3700 of the California Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that Code and I will comply with such provisions before commencing the performance of the Work of the Contract." The form of such Certificate is included as part of the Contract Documents.

9. Prevailing Wage Rate. In accordance with the provisions of §1700, et. seq. of the Labor Code, the Director of the Department of Industrial Relations of the State of California has determined the general prevailing rates of wages and employer payments for health and welfare, pension, vacation, travel time, and subsistence pay as provided for in §1773.8. Said wages are on file with the Department of Industrial Relations, Division of Apprenticeship Standards, 445 Golden Gate

Avenue, San Francisco, CA, as well as the District, and are available to any interested party upon request. It shall be mandatory upon the Contractor and upon any Subcontractor to pay not less than the specified rates to all laborers, workers, and mechanics employed by them in the execution of the Contract.

10. DIR Registration Requirements.

10.1. DIR Registration Verification. A form of DIR Registration Verification is included with the Contract Documents. Each Bidder shall submit the completed DIR Registration Verification form executed by a duly authorized officer or employee of the Bidder with the Bidder's Proposal for the Work; failure of a Bidder to do so may allow the District to render the Bid Proposal non-responsive.

10.2. Bidder DIR Registered Contractor Status. In addition to other requirements established herein relating to Bidder qualifications in order to be deemed "qualified" to submit a proposal for the Work, the Bidder must be a DIR Registered Contractor when submitting a proposal. The proposal of a Bidder who is not a DIR Registered Contractor when the Bid Proposal is submitted may be rejected for non-responsiveness.

10.3. Subcontractors' DIR Registered Contractor Status. All Subcontractors identified in a Bidder's Subcontractors' List must be DIR Registered Subcontractors at the time of submittal of the Bid Proposal for Work. The foregoing notwithstanding, a Proposal is not subject to the rejection for non-responsiveness when the Subcontractors List accompanying the Bid Proposal lists any Subcontractor(s) who is/are not DIR Registered Contractors if the listed Subcontractor(s) who are not DIR Registered become DIR Registered prior to the opening of proposals or become DIR Registered within twenty-four (24) hours of the opening of proposals pursuant to Labor Code §1771.1(c)(1) or (2). If the Subcontractors List accompanying the Bid Proposal lists any Subcontractor(s) who is/are not DIR Registered Contractors and the listed Subcontractor(s) who is/are not DIR Registered do not become DIR Registered prior to the opening of proposals or become DIR Registered within twenty-four (24) hours of the opening of proposals pursuant to Labor Code §1771.1(c)(1) or (2), such proposal is not subject to the rejection for non-responsiveness, provided that if the Bidder submitting the Subcontractors List with non-DIR Registered Subcontractor(s) is awarded the Contract for the Work, the Bidder shall request consent of the District to substitute another Subcontractor for the non-DIR Registered Subcontractor pursuant to Labor Code §1771.1(c)(3), without adjustment of the Contract Price or the Contract Time.

11. Contractor's License. No Bid Proposal will be considered from a Bidder who, at the time Bid Proposals are publicly opened, is not licensed to perform the Work, in accordance with the Contractor's License Law, California Business & Professions Code §7000 et. seq. This requirement is not a mere formality and will not be waived by the District or its Board of Trustees.

12. Drug-Free Workplace Certificate. In accordance with California Government Code §§8350 et seq., the Drug Free Workplace Act of 1990, the successful Bidder will be required to execute a

Drug Free Workplace Certificate concurrently with execution of the Agreement. The successful Bidder will be required to implement and take the affirmative measures outlined in the Drug Free Workplace Certificate and in California Government Code §§8350 et seq. Failure of the successful Bidder to comply with the measures outlined in the Drug Free Workplace Certificate and in California Government Code §§8350 et seq. may result in penalties, including without limitation, the termination of the Agreement, the suspension of any payment of the Contract Price otherwise due under the Contract Documents and/or debarment of the successful Bidder.

13. Examination of Site and Contract Documents. Each Bidder shall, at its sole cost and expense, inspect the Site and become fully acquainted with the Contract Documents and conditions affecting the Work. However, no bidder shall visit the site without prior authorization; all Bidders are required to contact the College of the Sequoias – Facilities Office for coordination of site visits. Submission of a Bid Proposal constitutes acceptance of the terms of this provision. Failure of a Bidder to receive or examine any of the Contract Documents or to inspect the Site prior to submitting a Bid Proposal shall not relieve such Bidder from any obligation with respect to the Bid Proposal or the Work required under the Contract Documents. The District assumes no responsibility or liability of any Bidder for, nor shall the District be bound by, any understandings, representations or agreements of the District's agents, employees or officers concerning the Contract Documents or the Work made prior to execution of the Contract which are not in the form of Bid Addenda duly issued by the District. The submission of a Bid Proposal shall be deemed prima facie evidence of the Bidder's full compliance with the requirements of this section.

14. Bidder's Assumptions. Neither the District nor its employees or representatives shall be responsible for any assumptions used by the Bidder in calculating its Bid Proposal Amount including, without limitation, assumptions regarding costs of labor, materials, equipment and proposed but unapproved substitutions or alternatives. The successful Bidder, upon award of the Contract by the District, if any, will be required to complete the Work for the amount identified in the Bid Proposal, within the Contract Time and in accordance with the Contract Documents.

15. Agreement. The Agreement in which the successful Bidder, as Contractor, will be required to execute, is included in the Contract Documents, and shall be carefully examined by the Bidder. The required number of executed copies of the Agreement is specified in the Contract Documents.

16. Addenda or Bulletins. Any addenda or bulletins issued during the time of bidding shall form a part of the drawings and specifications issued to Bidders for the preparation of their Proposals and shall constitute a part of the Contract Documents.

17. Modifications. Before the public opening and reading of Bid Proposals, the District may modify the Work, the Contract Documents, or any portion(s) thereof by the issuance of written addenda disseminated to all Bidders who have obtained a copy of the Bid Package (Specifications, Drawings and Contract Documents) pursuant to the Notice to Bidders. If the District issues any addenda during the bidding process, the failure of any Bidder to acknowledge such addenda in its Bid Proposal may render the Bid Proposal non-responsive and rejected. Changes to the bid forms which are not specifically called for or permitted may result in the District's rejection of the Bid Proposal as being non-responsive. No oral or telephonic modification of any submitted Bid Proposal will be considered. A written request for interpretation, clarification or correction to the Bid Documents from an interested Bidder may be considered for publication via addenda only if

received by the District at least seventy-two (72) hours prior to the scheduled closing time for receipt of Bid Proposals and the public opening thereof. The District will not respond to any requests for clarification or interpretation of the Bid Documents within seventy-two (72) hours of the scheduled bid opening. The District will not be responsible for any third party direction or instructions to bidders not specifically identified in the General and Supplemental Conditions, Notice to Bidders, and/or Instructions to Bidders. Only communication issued by the contact person(s) identified in the Notice to Bidders ("LOCATION FOR OBTAINING BID AND CONTRACT DOCUMENTS") shall be valid**.**

18. Award of Contract.

18.1. Waiver of Irregularities or Informalities. The District reserves the right to accept or reject any and all Bid Proposals, or to waive any irregularities or informalities in any Bid Proposal or in the bidding process.

18.2. Determination of Lowest Priced Bid Proposal; Award of Contract. Award of the Contract for a Bid Package, if made by the District through action of its Board of Trustees, will be to the responsible Bidder whose Base Bid is the lowest of those bids received. The foregoing notwithstanding, the scope of the Contract awarded for a Bid Package will be limited to the Base Bid and such Alternate Bid Items as determined by the District in its discretion, based on available funding.

18.3. Alternate Bid Items. If the Bid Proposal includes an Alternate Bid Item(s), the price(s) proposed by a Bidder for each Alternate Bid Item shall be set forth on the Bid Proposal. Failure of the Bidder to propose prices for each Alternate Bid Item listed on the Bid Proposal will render the Bid Proposal non-responsive and rejected.

18.4. Alternate Bid Items Not Included in Award of Contract. Bidders are referred to the provisions of the Contract Documents permitting the District, during performance of the Work, to add or delete from the scope of the Work any or all of the Alternate Bid Items with the cost or credit of the same being the amount(s) set forth by each Alternate Bid Item in the Bid Proposal.

18.5. Responsive Bid Proposal. A responsive Bid Proposal shall mean a Bid Proposal which conforms, in all material respects, to the Bid and Contract Documents.

18.6. Evidence of Responsibility. The District may request that a bidder submit promptly to the District satisfactory evidence showing the Bidder's financial resources, the Bidder's experience in the type of work being required by the District, the Bidder's organization available for the performance of the Contract and any other required evidence of the Bidder's qualifications to perform the proposed Contract. The District may consider such evidence before making its decision to award the proposed Contract. Failure to submit evidence of a Bidder's responsibility to perform the proposed Contract may result in rejection of the Bid Proposal.

18.7. Responsible Bidder. A responsible Bidder is a Bidder who has the capability in all

respects, to perform fully the requirements of the Contract Documents and the moral business integrity and reliability which will assure good faith performance. In determining responsibility, the following criteria will be considered: (i) the ability, capacity and skill of the Bidder to perform the Work of the Contract Documents; (ii) whether the Bidder can perform the Work promptly and within the time specified, without delay or interference; (iii) the character, integrity, reputation, judgment, experience and efficiency of the Bidder; (iv) the quality of performance of the Bidder on previous contracts, by way of example only, the following information will be considered: (a) the administrative, consultant or other cost overruns incurred by the District on previous contracts with the Bidder; (b) the Bidder's compliance record with contract general conditions on other projects; (c) the submittal by the Bidder of excessive and/or unsubstantiated extra cost proposals and claims on other projects; (d) the Bidder's record for completion of work within the contract time and the Bidder's compliance with the scheduling and coordination requirements on other projects; (e) the Bidder's demonstrated cooperation with the District and other contractors on previous contracts; (f) whether the work performed and materials furnished on previous contracts was in accordance with the Contract Documents; (v) the previous and existing compliance by the Bidder with laws and ordinances relating to contracts; (vi) the sufficiency of the financial resources and ability of the Bidder to perform the work of the Contract Documents; (vii) the quality, availability and adaptability of the goods or services to the particular use required; (viii) the ability of the Bidder to provide future maintenance and service for the warranty period of the Contract; (ix) whether the Bidder is in arrears on debt or contract or is a defaulter on any surety bond; (x) whether the Bidder has accomplished similar construction work in a safe manner as reflected by the Workman's Compensation Experience Modification Rating of less than 1.25; and (xi) such other information as may be secured by the District having a bearing on the decision to award the Contract, to include without limitation the ability, experience and commitment of the Bidder to properly and reasonably plan, schedule, coordinate and execute the Work of the Contract Documents and whether the Bidder has ever been debarred from bidding or found ineligible for bidding on any other projects. The ability of a Bidder to provide the required bonds will not of itself demonstrate responsibility of the Bidder.

18.8. Bid Negotiations. A bid response to any specific item of this bid with terms such as "negotiable", "will negotiate" or similar, will be considered as non-compliance with that specific item.

18.9. Notice of Intent to Award Contract. Following the public opening and reading of Bid Proposals, the District will issue a Notice of Intent to Award the Contract, identifying the Bidder to whom the District intends to award the Contract and the date/time/place of the District's Board of Trustees meeting at which award of the Contract will be considered. The Bid Tabulation sheet identifying all Bid Proposals received by the District for the Work will also be included in the Notice of Award documents.

18.10. Public Records. Bid Proposals and other documents responding to the Notice to Bidders become the exclusive property of the District upon submittal to the District.

At such time as the District issues the Notice of Intent to Award the Contract pursuant to these Instructions to Bidders, all Bid Proposals and other documents submitted in response to the Notice to Bidders become a matter of public record and shall thereupon be considered public records, except for information contained in such Bid Proposals deemed to be Trade Secrets (as defined in California Civil Code §3426.1) and information provided in response to the Statement of Qualifications (if applicable). A Bidder that indiscriminately marks all or most of its Bid Proposal as exempt from disclosure as a public record, whether by the notations of "Trade Secret," "Confidential," "Proprietary," or otherwise, may render the Bid Proposal non-responsive and rejected. The District is not liable or responsible for the disclosure of such records, including those exempt from disclosure if disclosure is deemed required by law, by an order of Court, or occurs through inadvertence, mistake or negligence on the part of the District or its officers, employees or agents. At such time as Bid Proposals are deemed a matter of public record, pursuant to the above, any Bidder or other party shall be afforded access for inspection and/or copying of such Bid Proposals, by request made to the District in conformity with the California Access to Public Records Act, California Government Code §§6250, et. seq. If the District is required to defend or otherwise respond to any action or proceeding wherein request is made for the disclosure of the contents of any portion of a Bid Proposal deemed exempt from disclosure hereunder, the Bidder submitting the materials sought by such action or proceeding agrees to defend, indemnify and hold harmless the District in any action or proceeding from and against any liability including, without limitation, attorneys' fees arising therefrom. The party submitting materials sought by any other party shall be solely responsible for the cost and defense in any action or proceeding seeking to compel disclosure of such materials; the District's sole involvement in any such action shall be that of a stakeholder, retaining the requested materials until otherwise ordered by a court of competent jurisdiction.

18.11. Bid Protest. Any Bidder submitting a Bid Proposal to the District may file a protest of the results of the public bid opening provided that each and all of the following are complied with: (i) the bid protest is in writing; (ii) the bid protest is filed and received by the District's Vice President of Administrative Services not more than seventy-two (72) hours following the date and time of the public bid opening (excluding weekends and holidays as identified per the District's academic calendar); and (iii) the written bid protest sets forth, in detail, all grounds for the bid protest, including without limitation all facts, supporting documentation, legal authorities and argument in support of the grounds for the bid protest; any matters not set forth in the written bid protest shall be deemed waived. All factual contentions must be supported by competent, admissible, and credible evidence.

19. Prices. Bidders must quote prices F.O.B. the District unless otherwise noted. Prices should be stated in the unit specified and Bidders should quote each item separately.

20. Taxes. Taxes shall be included in all prices in the Bid Proposal. The District will pay only the State sales and use taxes. Federal excise taxes are not applicable to Community College Districts.

21. Quantities. The quantities shown are approximate. The District reserves the right to increase

or decrease quantities as desired.

22. Samples. On request, samples of the products being bid shall be furnished to the District.

23. Substitution of Specified Project Items. Pursuant to Public Contract Code §3400, the District will consider proposed substitutions to materials, equipment, products and other items specified in the Contract Documents ("Specified Project Items") only during the bidding process. No proposed substitutions will be considered nor will consent be granted to furnish and install any substitution for Specified Project Items. The following is the process which bidders must comply with during the bidding process in order for the District to consider a proposed substitution of any Specified Project Items.

23.1. Bidder's Substitution Request. Any Bidder seeking District consent to furnish or install a substitution for any Specified Project Item must submit a written request to the College of the Sequoias – Facilities Office no later than seven (7) days before the date of the bid opening. The District will consider proposed substitutions only if the Bidder proposing substitution complies with each and all of the following: (i) the request to consider a proposed substitution is in writing ("the Substitution Request") and submitted to the correct location prior to the date set forth above; (ii) the Substitution Request identifies the Specified Project Item for which the substitution is proposed by reference to specific page(s) and detail(s) of the Drawings and/or specific section(s) of the Specifications; (iii) the proposed substitution is fully identified and described, including without limitation, manufacturer's literature, specifications, catalog cut sheets, and other similar materials; and (iv) the Substitution Request incorporates all technical, aesthetic and other related materials demonstrating the equivalency of the proposed substitution to the Specified Project Item, including without limitation, engineering calculations, UL listing, ASTM standards and other similar matters.

23.2. District Review. Provided that a Bidder has complied with the requirements for submittal of a substitution request, the District, Engineer and the Engineer's Design Consultants will review the Substitution Request and all accompanying materials to determine the equivalency of the proposed substitution to the Specified Project Item. If in such review, the District or Engineer request that the Bidder submitting the Substitution Request furnish additional or supplemental information/data, such Bidder must within the time establish furnish such information/data; failure to timely respond to any request for additional or supplemental information/data may result in the District's summary rejection of the Substitution Request. Unless patently without substantive basis, the determination of equivalency or non-equivalency by the Engineer is deemed the Engineer's exercise of discretion which shall not subject to administrative or judicial appeal or review.

23.3. Notice of Acceptance/Rejection of Proposed Substitution. If upon considering a Substitution Request, the Engineer determines that the proposed substitution is not equivalent to the Specified Project Item, the Bidder submitting the Substitution Request will be notified in writing of the rejection of the proposed substitution. If upon considering a Substitution Request, the Engineer determines that the proposed

substitution is equivalent to the Specified Project Item, the Bidder submitting the Substitution Request will be notified in writing of the District's acceptance of the proposed substitution and an Addenda will be issued to all Bidders notifying Bidders of the District's acceptance of a substitution for a Specified Project Item. In such event, the Bidders' Bid Proposals may be based upon the Specified Project Item or the District accepted substitution for a Specified Project Item. The District reserves the right to make all decisions on product and vendor selections.

23.4. District Standard Products. If any portion of the Contract Documents describes a Specified Project Item as a District standard material, equipment or other product, pursuant to Public Contract Code §3400(b), the District will not consider any proposed substitutions to such District standard material, equipment or other product.

24. Storage Container Costs and Delivery. All costs for storage containers shall be borne by the Bidder. All products shall conform to the provisions set forth in the federal, county, state and city laws for their production, handling, processing and labeling. Packages shall be constructed to insure safe transportation to point of delivery. The Bidder shall be responsible for the security of material storage at all times.

25. Contractor's Liability Insurance. Contractor shall purchase and maintain such insurance as will protect Contractor from claims for damages because of bodily injury, including death, and from claims for damages to property which may arise out of or result from Contractor's operations under this Contract, whether such operations be by Contractor or by any Subcontractor or anyone directly or indirectly employed by any of them. This insurance shall name the District as an additional insured by separate endorsement and shall be written for not less than One Million Dollars ($1,000,000) combined single limit, bodily injury and property damage. If the policy limits include a general aggregate, the general aggregate shall be a limit of not less than Two Million Dollars ($2,000,000). Certificates of such insurance shall be filed with the District immediately following the District's issuance of Notice of Award of the Bid Proposal. The Certificate of Insurance will state that the contractual liability assumed under this paragraph is covered and shall provide that a thirty (30) day notice of cancellation or reduction in coverage shall be provided to the District.

26. Anti-Discrimination. It is the policy of the District that in connection with all work performed under contracts, there will be no discrimination against any prospective or active employee engaged in the Work because of race, color, ancestry, national origin, religious creed, sex, age or marital status. The Contractor agrees to comply with applicable Federal and California laws including, but not limited to, the California Fair Employment Practice Act, beginning with Labor Code §1410, and Labor Code §1735. In addition, the Contractor agrees to require like compliance by any Subcontractors employed on the Work.

27. Compliance with Immigration Reform and Control Act of 1986. The Bidder is solely and exclusively responsible for employment of individuals for the Work of the Contract in conformity with the Immigration Reform and Control Act of 1986, 8 USC §1101 et seq. (the "IRCA"); the successful Bidder shall also require that any person or entity employing labor in connection with any of the Work of the Contract shall so similarly comply with the IRCA.

28. Prevailing Law. In the event of any conflict or ambiguity between these instructions and state or federal law or regulations, the latter shall prevail. Additionally, all equipment to be supplied or service to be performed under the Bid Proposal shall conform to all applicable requirements of local, state and federal law.

29. Governing Law and Venue. In the event of litigation, the bid documents, specifications, and related matters shall be governed by and construed in accordance with the laws of the State of California. Venue shall be with the appropriate state or federal court located in Tulare County.

30. Rights and Remedies in the Event of Default. If the Bidder defaults, the District may procure the articles or services from other sources and may recover the loss occasioned thereby from any unpaid balance due the Bidder or by proceeding against a Bidder's Bond(s), if any, or by suit against the Bidder. The prices paid by the District shall be considered the prevailing market prices at the time such purchase is made.

31. Liquidated Damages. In accordance with Government Code §53069.85, for each calendar day completion of the Work is delayed beyond the time specified in the Agreement, Contractor agrees to forfeit and pay the Owner the specified amount(s) identified in the **Special Conditions, Article 9** (District Withhold of Liquidated Damages; Performance Bond Surety), which shall be deducted from any payments due to or to become due to the Contractor. Contractor shall review and fully understand the specified Liquidated Damages associated with each Milestone Event identified in the Project Schedule; see Special Conditions Articles 8 and 9 for additional information. Liquidated Damages shall be imposed until final completion of the entire work in conformity with all the terms, conditions, and requirements of the Contract Documents.

32. Indemnity. The Bidder must hold harmless and fully indemnify the District, its Board of Trustees, officers, employees and agents from all damages or claims for damages, costs or expenses that may at any time arise out of the Bidder's performance, or failure to perform acts, required by the Contract Documents, including, but not limited to, infringement or use of any copyrighted composition, secret process, patented or unpatented invention, article or appliance furnished or used in connection with this Bid Package.

[End of Section]

BID PROPOSAL

(To be submitted with bid)

Project: **COS Student Union**

To: Board of Trustees
Sequoias Community College District
915 S. Mooney Blvd.
Visalia, CA 93277

Bids Proposals must be sealed and submitted to the College of the Sequoias - Visalia Campus, Sequoia Building – Room 1 (Admin Wing), 915 S. Mooney Blvd., Visalia, CA 93277 no later than **Tuesday, October 27th, 2026 @ 2:00 p.m.**

Work shall be completed within 870 calendar days from the notice to proceed, see Project Manual (Special Conditions, Article 8. Milestones.) for Project Schedule restrictions and requirements. The estimate construction budget is **Thirty-two Million Dollars ($32,000,000).**

Pursuant to and in compliance with the Contract Documents, the undersigned Bidder, having examined documents pertaining to the project as well as having visited the site and examined conditions relating thereto, proposes and agrees to perform all construction required for **COS Student Union**, within the time stipulated, including all addenda for the sum(s) indicated below.

Scope of Work: Furnish all labor, equipment and materials and related items necessary and required to complete the Work as indicated for **Sequoias Community College District** pursuant to the attached minimum specifications.

In accordance with Public Contract Code §20103.8.b, the low Bidder for this project will be the lowest responsive, responsible Bidder whose **Base Bid** is the lowest of those bids received.

The receipt of the following addenda to the Drawings and Specification is acknowledged:

Addendum No(s): _____

BASE BID:

_____ ($_____)
WRITTEN IN WORDS FIGURES

Execution and delivery of Documents: The Undersigned agree(s) to sign the proposed Agreement upon Award of Contract and furnish the required Bonds and Certificates of Insurance required with the Bid Proposal. If the Undersigned defaults in executing and delivering the above-named Agreement, Bonds, and Certificates of Insurance, the accompanying Bid Bond or Bid Security and the money payable thereon shall become and remain the property of the District. The Undersigned agree(s) that this bid may not be withdrawn for a period of forty-five (45) days after the date set for the opening of bids. The undersigned declares under penalty of perjury under the laws of the State of California that the representations made in the bid are true and correct.

_____ _____

SIGNATURE DATE

_____ _____

PRINTED NAME TITLE

_____

COMPANY NAME (AS LICENSED)

_____ / _____ / _____

CONTRACTOR LICENSE NO. CLASS EXPIRATION DATE

_____

ADDRESS

_____ _____ _____

CITY STATE ZIP CODE

(_____)_____ (_____)_____

PHONE FAX

_____

EMAIL

BID BOND

(to be submitted with bid)

KNOW ALL MEN BY THESE PRESENTS that we, the undersigned _____ as Principal, and _____, as Surety, are jointly and severally, along with their respective heirs, executors, administrators, successors and assigns, held and firmly bound unto Sequoias Community College District, hereinafter the "Owner" for payment of the penal sum hereof in lawful money of the United States, as more particularly set forth herein.

The condition of the above obligation is such that whereas the Principal has submitted the accompanying Bid Proposal dated _____, 20_____, which, inclusive of additive Bid Alternate Items, if any, is in the amount of _____ Dollars ($_____) to the Owner for the Work commonly described as **COS Student Union** Project.

WHEREAS, subject to the terms of this Bond, the Surety is firmly bound unto the Owner in the penal sum of TEN PERCENT (10%) of the maximum amount of the Bid Proposal submitted by the Principal to the Owner, as set forth above.

NOW, THEREFORE,

a. If said bid shall be rejected, or, in the alternative,

b. If said bid shall be accepted and the Principal shall execute and deliver a Contract in the form of Agreement attached hereto and shall in all other respects perform the Agreement created by the acceptance of said bid.

Then this obligation shall be void, otherwise the same shall remain in force and effect, it being expressly understood and agreed that the liability of the Surety for any and all default of the Principal hereunder shall be the amount of this obligation as herein stated.

Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract on the Notice to Bidders, or to Work to be performed thereunder, or the Specifications accompanying the same, shall in anywise affect its obligation under this bond and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of said Contract or the Notice to Bidders, or to the Work, or to the Specifications.

In the event suit is brought upon this bond by Owner and judgement is recovered, Surety shall pay all costs incurred by Owner in such suit, including reasonable attorney's fees fixed by the court.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this _____ day of _____, 20_____. The name and corporate party being hereto affixed, and these presents duly signed by its undersigned representative, pursuant to authority of its governing body. In presence of:

PRINCIPAL

_____
NAME

_____
TITLE

_____
ADDRESS

_____
CITY / STATE / ZIP CODE

_____
TELEPHONE

(PRINCIPAL SEAL)

SURETY

_____
NAME

_____
TITLE

_____
ADDRESS

_____
CITY / STATE / ZIP CODE

_____
TELEPHONE

(SURETY SEAL)

SUBCONTRACTORS LIST

(To be submitted with bid)

Project: **COS Student Union**

Listed hereinafter is the name and address of each Subcontractor who will be employed and the kind of work which each will perform if the Contract is awarded to the aforesigned. I understand that under Public Contract Code §4100 through §4113* I must clearly set forth the name and address of each Subcontractor who will perform work or labor or render service to me in or about the construction of the Work in an amount in excess of one-half of one percent (1/2 of 1%) of my total Bid Proposal amount and that as to any work which I fail to do so, I agree to perform that portion of Work myself or be subject to penalty under the act.

In case more than one Subcontractor is named for the same kind of work, i.e., installation, state the portion of work that each will perform. Provide Contractor License number and DIR Registration number for each Subcontractor. Vendors or suppliers of materials only need not be listed.

If further space is required for the list of proposed Subcontractors, additional sheets showing the required information, as indicated below, shall be attached hereto, and made a part of the Proposal.

KIND OF WORK COMPANY NAME/LOCATION LICENSE # DIR REGISTRATION #

_____

_____

_____

_____

_____

_____

_____

_____

* NOTE: The above listing requirement will for purposes of this Proposal be construed in accordance with the provisions of the Subletting and Subcontracting Fair Practices Act ("The Act") as set forth in Government Code §4100 through §4113. Also, for purposes of this Proposal and interpretation of The Act, a vendor will be considered to be a Prime Contractor regardless of whether such vendor is or is not a licensed Contractor.

NON-COLLUSION AFFIDAVIT

(to be submitted with bid)

Project: **COS Student Union**

I,_____(Name), being first duly sworn, deposes and says that I am the (Title) of _____(Contractor), the party making the foregoing bid, that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the Bidder has not directly or indirectly induced or solicited any other Bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any Bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the Bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true, and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

Executed this _____ day of _____, 20_____ at _____(City/County/State).

I declare under penalty of perjury under the law of the State of California that the foregoing is true and correct.

_____ _____

SIGNATURE PRINTED NAME

_____

ADDRESS / CITY / STATE / ZIP CODE

(_____)_____

PHONE

CONTRACTOR'S CERTIFICATE REGARDING WORKERS' COMPENSATION

(To be submitted with bid)

Project: **COS Student Union**

Labor Code §3700 provides:

"Every employer except the State and all political subdivisions or institutions thereof, shall secure the payment of compensation in one or more of the following ways:

a) By being insured against liability to pay compensation in one or more insurers duly authorized to write compensation insurance in this State.

b) By securing from the Director of Industrial Relations a certificate of consent to self-insure which may be given upon furnishing proof of satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to his or her employees."

I am aware of the provisions of §3700 of the Labor Code which require every employer to be insured against liability for Workers' Compensation or to undertake self-insurance in accordance with the provisions of that Code and I will comply with those provisions before commencing the performance of the Work of this Contract.

_____
SIGNATURE

_____
PRINTED NAME

_____
TITLE

_____
DATE

(In accordance with Article 5 [commencing at §1860], Chapter 1, Part 7, Division 2 of the Labor Code, this Certificate must be signed and filed with the awarding body prior to performing any work under this Contract.)

PREVAILING WAGE COMPLIANCE CERTIFICATION

(to be submitted with bid)

Project: **COS Student Union**

To: Sequoias Community College District
915 S. Mooney Blvd.
Visalia, CA 93277

I hereby certify that I will conform to the State of California Public Works Contract Requirements regarding wages; benefits; on-site audits with 48-hour notice; payroll records; and, apprentice and trainee employment requirements.

_____
SIGNATURE

_____
PRINTED NAME

_____
TITLE

_____
DATE

VERIFICATION OF CONTRACTOR AND SUBCONTRACTORS' DIR REGISTRATION

(to be submitted with bid)

Project: **COS Student Union**

I,_____(Name), being first duly sworn, deposes and says that I am the (Title) of _____(Bidder).

1. The Bidder is currently registered as a Contractor with the Department of Industrial Relations ("DIR").

2. The Bidder's DIR Registration Number is: _____. The expiration date of the Bidder's DIR Registration is June 30, 20_____.

3. If the Bidder is awarded the Contract for the Work and the expiration date of the Bidder's DIR Registration will occur: (i) prior to expiration of the Contract Time for the Work; or (ii) prior to the Bidder completing all obligations under the Contract for the Work, the Bidder will take all measures necessary to renew the Bidder's DIR Registration so that there is no lapse in the Bidder's DIR Registration while performing Work under the Contract.

4. The Bidder, if awarded the Contract for the Work, will remain a DIR Registered Contractor for the entire duration of the Work.

5. The Bidder has independently verified that each Subcontractor identified in the Subcontractors List submitted with the Bid Proposal of the Bidder is currently a DIR Registered Contractor.

6. The Bidder has provided the DIR Registration Number for each Subcontractor identified in the Bidder's Subcontractors List or, within twenty-four (24) hours of the opening of Bid Proposals for the Work, the Bidder will provide the District with the DIR Registration Number for each subcontractor identified in the Bidder's Subcontractors List.

7. The Bidder's solicitation of Subcontractor bids included notice to prospective Subcontractors that: (i) all sub-tier Subcontractors must be DIR Registered Contractors at all times during performance of the Work; and (ii) prospective Subcontractors may only solicit sub-bids from and contract with lower-tier Subcontractors who are DIR Registered Contractors.

8. If any of the statements herein are false or omit material facts rendering a statement to be false or misleading, the Bidder's Bid Proposal is subject to rejection for non-responsiveness.

9. I have personal first had knowledge of all of the foregoing information.

Executed this _____ day of _____, 20_____ at _____(City/County/State).

I declare under penalty of perjury under the law of the State of California that the foregoing is true and correct.

_____ _____

SIGNATURE PRINTED NAME

ADDRESS / CITY / STATE / ZIP CODE

(_____)_____

PHONE

AGREEMENT

THIS AGREEMENT is made the _____ day of _____, 20_____, in the city of **Visalia**, County of **Tulare**, State of California, by and between **Sequoias Community College District, 915 S. Mooney Blvd., Visalia, CA 93277**, hereinafter "Owner" and _____, hereinafter "Contractor," with its principal place of business in _____(city/state).

WITNESSETH, that the Owner and the Contractor in consideration of the mutual covenants contained herein agree as follows:

ARTICLE I: THE WORK. Within the Contract Time and for the Contract Price, subject to adjustments thereto pursuant to the Contract Documents, the Contractor shall perform and provide all necessary labor, materials, tools, equipment, utilities, services, and transportation to complete within the agreed Contract Time in a workmanlike manner, all of its Work required in connection with the Work of improvement commonly referred to as: COS Student Union Project. Contractor shall complete all of its Work covered by the Contract Documents, including without limitation, the Drawings and Specifications prepared by architectural and engineering consultants, and all Contract Documents included in the Instructions to Bidders, along with all modifications and addenda thereto issued in accordance with the Contract Documents.

ARTICLE II: CONTRACT DOCUMENTS. The Contract Documents shall consist of this Agreement, the Specifications and Drawings, all addenda, and bulletins thereto, the Notice to Bidders, Instructions to Bidders, General Conditions, Special Conditions, all documents forming a part of the Bid Package and any other documents signed by both parties relating to the subject matter of this Agreement. The intention of the Contract Documents is to include all labor, materials, equipment, and other items necessary for the proper execution and completion of the Work and the terms and conditions of payment therefore, and also to include all Work which may be reasonably inferable from the Contract Documents as being necessary to produce the intended results.

2.1 The Specifications and Drawings are intended to cooperate so that any work exhibited in the Drawings and not mentioned in the Specifications, or vise-versa, is to be executed the same as if both mentioned in the Specifications and set forth in the Drawings, to the true intent and meaning of said Drawings and Specifications when taken together.

2.2 The term "Work" as used in the Contract Documents includes all labor necessary to produce the construction required by the Contract Documents and all materials and equipment incorporated or to be incorporated in such construction.

ARTICLE III: CONTRACT TIME. The Work shall be commenced on the construction start date identified in the Owner's Notice to Proceed; the Contractor shall achieve Substantial Completion of the Work within the Contract Time delineated within the construction schedule from and after the Commencement Date set forth in the Notice to Proceed.

ARTICLE IV: CONTRACT PRICE. The Owner shall pay the Contractor as full consideration for the Contractor's full, complete and faithful performance of the Contractor's obligations under the Contract Documents, subject to any additions or deduction as provided for in the Contract Documents, the Contract Price of _____ Dollars ($_____). The Contract Price is based upon the Contractor's Base Bid Proposal plus the following Alternate Bid Item(s), if any: _____. The Owner's payment of the Contract Price shall be in accordance with the Contract Documents.

ARTICLE V: CONTRACTOR.

5.1 Contractor acknowledges that he is an independent Contractor and not an employee, agent, or representative of the Owner. Contractor acknowledges that he shall be solely responsible for and shall indemnify and hold Owner harmless from all matters relating to payment of Contractor's employees, Subcontractors, and others, including compliance with Social Security, payroll withholding and all other regulations governing such matters.

5.2 Contractor shall supervise and direct the Work using Contractors best skill and attention. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work under the Contract.

5.3 Unless otherwise specifically noted, the Contractor shall provide and pay all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation and other facilities and services necessary for the proper execution and completion of the Work.

5.4 Contractor shall at all times enforce strict discipline and good order among Contractor's employees, and shall not employ on the Work any unfit person or anyone not skilled in the task assigned.

5.5 Contractor represents and warrants to Owner that all materials and equipment incorporated in the Work will be new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All Work not so conforming to these standards may be considered defective. This warranty shall be in addition to any other warranty provided by law or Contract.

5.6 Contractor shall pay all sales, consumer, use and other similar taxes required by law and shall secure and pay for all permits, fees and licenses necessary for the execution of the work.

5.7 Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and orders of any public authority bearing on the performance of the Work, and shall notify the Owner if any of the Contract Documents are at variance therewith.

5.8 Contractor shall be responsible for the acts and omissions of all Contractor's employees and all subcontractors, their agents and employees and all other persons performing any of the work under a contract with the Contractor.

5.9 The Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by Contractor's operations. At the completion of the work, Contractor shall remove all Contractor's waste materials and rubbish from and about the Project as well as Contractor's tools, construction equipment, machinery and surplus materials. If the Contractor fails to clean up, the Owner may do so and charge the cost to the Contractor.

5.10 Contractor has made an independent investigation of the job site, including underground conditions, and all other conditions that might affect the progress of the Work and is satisfied as to those conditions.

5.11 The Contractor shall perform all Work in compliance to CCR Title 24, Part 1, 4-343.

ARTICLE VI: SUBCONTRACTS.

6.1 Contractor agrees to bind every Subcontractor by the terms of this Contract as far as applicable to the Subcontractors work. If Contractor subcontracts any part of this Contract, Contractor shall be responsible to the Owner for any acts and omissions of its Subcontractors and of persons either directly or indirectly employed by its Subcontractors. Nothing contained in this agreement shall create a contractual relationship between Subcontractor and Owner.

6.2 Contractor shall not employ any Subcontractor to whom the Owner may have a reasonable objection. Owner's consent to or approval of any Subcontractor shall not relieve Contractor of its obligations under this Contract.

6.3 Substitution of Subcontractors shall be permitted only as authorized by Public Contract Code §4100, et. seq.

6.4 All Subcontractors shall be appropriately licensed to perform the Work for which

employed in conformity with the laws of the State of California.

ARTICLE VII: PAYMENT SHCEDULE.

7.1 On or before the 25th day of each month, Contractor shall submit to Owner an application for payment specifying in detail the labor and materials incorporated into the Work during that month. Owner's review of the application for payment and estimate of the value of labor and materials incorporated into the Work shall be final.

7.2 Owner shall pay to Contractor, by the 25th of the following month, 95% of the value of the requested payment as established by Owner, of the labor and materials incorporated into the Work during the previous month.

7.3 Upon the issuance and filing of a Notice of Completion, Owner shall have paid to Contractor, through monthly payments as set forth above, ninety-five percent (95%) of the Contract Sum. Five percent (5%) of the Contract Sum shall be retained by Owner for thirty-five (35) days following the filing of the Notice of Completion with the County in which the work was performed. Final payment of the retained percentage shall be made thirty-five (35) days after the Notice of Completion has been filed, provided that all Work has been completed and the Contract is then fully performed, subject to the provisions of Article VIII ("Payments") in this Agreement.

ARTICLE VIII: PAYMENTS.

8.1. Payments shall be made as provided in the provisions of Article VII in this Agreement.

8.2. Payments may be withheld on account of: (1) defective work not remedied; (2) claims filed; (3) failure of the Contractor to make payments properly to Subcontractors or for labor, materials, or equipment; (4) damage to another Contractor; or (5) unsatisfactory prosecution of the Work by the Contractor.

8.3. Final payment shall not be due until the Contractor has delivered to the Owner an unconditional release of all stop notices arising out of this Contract or receipts in full covering all labor, materials and equipment for which a lien could be filed, or a bond satisfactory to the Owner indemnifying the Owner against such notice of a lien.

ARTICLE IX: LIQUIDATED DAMAGES:

9.1. The time limit specified in Article III ("Contract Time") is of the essence of the Contract. The Contractor shall complete the Work by the date specified in Article III unless Owner agrees to a written extension of time in writing.

9.2. The term "day" as used in the Contract Documents shall mean calendar day.

9.3. Failure to complete the work within the time and in the manner provided for by the Contract Documents shall subject the Contractor to Liquidated Damages.

9.4. The actual occurrence of damages and the actual amount of the damages which the Owner would suffer if the Work were not completed within the specified times set forth are dependent upon many circumstances and conditions which could prevail in various combinations, and from the nature of the case, it is impracticable and extremely difficult to fix the actual damages. Damages which the Owner would suffer in the event of delay include loss of the use of the project, disruption of school activities, costs of administration, inspection, supervision and the loss suffered by the public within the District by reason of the delay in the construction of the Project. Accordingly, the parties agree that the amount herein set forth shall be presumed to be the amount of damages sustained by the failure of the Contractor to complete the Project within the time specified.

9.5. The amount of Liquidated Damages to be paid by the Contractor to the Owner for failure to complete the Work specified is identified in the **Special Conditions, Article 9** (District Withhold of Liquidated Damages; Performance Bond Surety), which shall be deducted from any payments due to or to become due to the Contractor. Contractor shall review and fully understand the specified Liquidated Damages associated with each Milestone Event identified in the Project Schedule; see Special Conditions Articles 8 and 9 for additional information. Liquidated Damages shall be incurred by the Contractor for each calendar day by which completion of the Project is delayed beyond the completion date identified in the Notice to Proceed, such amount being the actual cash value agreed upon as the loss to the Owner resulting from the Contractor's default.

9.6. In the event the Contractor shall become liable for Liquidated Damages under this section, the Owner, in addition to all other remedies provided by law, shall have the right to withhold any and all retained percentages of payments, and to collect the interest thereon, which would otherwise be or become due the Contractor until the liability of the Contractor under this section has been finally determined. If the retained percentage is not sufficient to discharge all liabilities of the Contractor incurred under this Article, the Contractor and its sureties shall continue to remain liable to the Owner until all such liabilities are satisfied in full.

ARTICLE X: AUTHORITY TO EXECUTE. The individual(s) executing this Agreement on behalf of the Contractor is/are duly and fully authorized to execute this Agreement on behalf of Contractor and to bind the Contractor to each and every term, condition and covenant of the Contract Documents.

ARTICLE XI: INDEMNITY. Contractor shall indemnify, hold harmless and defend Owner and its Board of Trustees, officers, agents and employees from and against all claims, damages, losses and expenses, including reasonable costs and attorney's fees arising out of or resulting from Contractor's performance of the Work or Work performed by Contractor's agents or employees, or Subcontractors

employed on the Project, their agents or employees, or products installed on the Project by Contractor or Subcontractors, excepting only such injury or harm as may be caused solely and exclusively by Owner's fault or negligence. Such indemnification shall extend to all claims, demands, or liabilities occurring after completion of the Project as well as during the progress of the Work.

IN WITNESS WHEREOF, the Owner and the Contractor as of the date set forth above have duly executed this Agreement.

CONTRACTORS ARE REQUIRED BY LAW TO BE LICENSED AND REGULATED BY THE CONTRACTOR'S STATE LICENSE BOARD. ANY QUESTIONS CONCERNING A CONTRACTOR MAY BE REFERRED TO THE REGISTRAR, CONTRACTOR'S STATE LICENSE BOARD, P.O. BOX 2600, SACRAMENTO, CALIFORNIA 95826.

"OWNER"	**"CONTRACTOR"**
_____	_____
SIGNATURE	SIGNATURE
_____	_____
PRINTED NAME	PRINTED NAME
_____	_____
TITLE	TITLE

CERTIFICATE OF LIABILITY INSURANCE (SAMPLE)

ACORD™ CERTIFICATE OF LIABILITY INSURANCE — DATE (MM/DD/YY)

PRODUCER

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURERS AFFORDING COVERAGE

INSURED

INSURER A:
INSURER B:
INSURER C:
INSURER D:
INSURER E:

COVERAGES

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
	GENERAL LIABILITY					
	[X] COMMERCIAL GENERAL LIABILITY				EACH OCCURRENCE	$ 1,000,000
	[ ] CLAIMS MADE [X] OCCUR				FIRE DAMAGE (Any one fire)	$ 100,000
					MED EXP (Any one person)	$ 5,000
					PERSONAL & ADV INJURY	$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:				GENERAL AGGREGATE	$ 2,000,000
	[ ] POLICY [ ] PRO-JECT [ ] LOC				PRODUCTS - COMP/OP AGG	$ 2,000,000
	AUTOMOBILE LIABILITY					
	[X] ANY AUTO				COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
	[ ] ALL OWNED AUTOS				BODILY INJURY (Per person)	$
	[ ] SCHEDULED AUTOS					
	[X] HIRED AUTOS				BODILY INJURY (Per accident)	$
	[X] NON-OWNED AUTOS					
					PROPERTY DAMAGE (Per accident)	$
	GARAGE LIABILITY				AUTO ONLY - EA ACCIDENT	$
	[ ] ANY AUTO				OTHER THAN AUTO ONLY: EA ACC	$
					AGG	$
	EXCESS LIABILITY				EACH OCCURRENCE	$
	[ ] OCCUR [ ] CLAIMS MADE				AGGREGATE	$
						$
	[ ] DEDUCTIBLE					$
	[ ] RETENTION $					$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY				[X] WC STATU-TORY LIMITS [ ] OTH-ER	
					E.L. EACH ACCIDENT	$ 1,000,000
					E.L. DISEASE - EA EMPLOYEE	$ 1,000,000
					E.L. DISEASE - POLICY LIMIT	$ 1,000,000
	OTHER					

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

College of the Sequoias, Prop. 39 Year 3 L.E.D. Retrofit Project Owner, Engineer(s), their officers, agents, and employees are hereby named as additional insured (Gen.Liab.) with waiver of subrogation (Gen. Liab. & Workers Comp.) as respects to work performed by the named insured & the insurance provided is primary. Endorsements are attached.

CERTIFICATE HOLDER

ADDITIONAL INSURED; INSURER LETTER: ___

Sequoias Community College District
915 S. Mooney Blvd
Visalia, CA 93277
Attn: Christine Statton
Vice President, Administrative Services

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

ACORD 25-S (7/97)

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SAMPLE

PERFORMANCE BOND

(To be submitted upon Notice of Award)

Project: **COS Student Union**

The undersigned _____(Contractor), hereinafter designated as the "Principal", and _____(Surety), as Surety, are held and firmly bound unto Sequoias Community College District, in the County of Tulare, State of California, hereinafter called the "Owner", in the amount of _____ Dollars ($_____), for the payment of which sum well and truly made, we bind ourselves, our heirs, executors, administrators or successors, jointly and severally, firmly by these presents.

The conditions of this obligation is such that whereas the Principal entered into a certain Contract with the Owner, dated _____, 20_____.

NOW, THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said Contract during the original term of said Contract and any extensions thereof that may be granted by the Owner, with or without notice to the Surety, and during the life of any guarantee required under the Contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, then, this obligation to be void, otherwise to remain in full force and virtue.

And the said Surety, for value received, hereby stipulates, and agrees that no changes, extension of time, alteration or addition to the terms of the Contract or to the Work to be performed thereunder, or the Specifications accompanying the same, shall in any ways affect its obligations of this bond and it does hereby waive notice of any such change, extension, alteration or additions.

IN WITNESS WHEREOF, the above bound parties have executed this instrument under their several seals the _____ day of _____, 20_____, the name and corporate seal of each corporate party being hereto affixed.

(To be signed by Principal and Surety and acknowledged and Notarial Seal attached.)

PRINCIPAL

_____
NAME

_____
TITLE

_____
ADDRESS

_____
CITY / STATE / ZIP CODE

_____
(PRINCIPAL SEAL) TELEPHONE

SURETY

_____
NAME

_____
TITLE

_____
ADDRESS

_____
CITY / STATE / ZIP CODE

_____
(SURETY SEAL) TELEPHONE

PAYMENT BOND

(LABOR AND MATERIAL)

(To be submitted upon Notice of Award)

Project: **COS Student Union**

The undersigned _____ (Contractor), and hereinafter designated as the "Principal", have entered into a contract for the furnishings of all materials and labor, services and transportation, necessary, convenient and proper to the project identified above.

Which said Agreement dated _____, 20_____, and all of the Contract Documents attached to or forming a part of said Agreement, are hereby referred to and made a part hereof; and WHEREAS, the Principal is required, before entering upon the performance of the Work, to file a good and sufficient bond with the body by whom the Contract is awarded to secure the claims arising under the said Agreement.

NOW, THEREFORE, THESE PRESENTS WITNESSETH:

That the said Principal and the undersigned _____ (Surety), a California admitted surety insurer, as Corporate Surety, are held and firmly bound into all laborers, material men and other persons referred to in said statues in the sum of the Contract Price of _____ Dollars ($_____), which sum well and truly be made, we bind ourselves, our heirs, executors, administrators, successors, or assigns, and severally, by these presents.

The conditions of this obligation is that if the said Principal or any of his or its subcontractors, or the heirs, executors, administrators, successors or assigns of any, all, or either of them, shall fail to pay for any materials, provisions, provender or other supplies, or teams, used in, upon, for, or about the performance of the Work contracted to be done, or for any work or labor thereon of any kind, or for amounts due under the Unemployment Insurance Act with respect to such work or labor, that said Surety will pay the same in an amount not exceeding the amount hereinabove set forth, and also in case suit is brought upon this bond, will pay a reasonable attorney's fee to be awarded and fixed by the Court, and to be taxed as costs and to be included in the judgement therein rendered.

It is hereby expressly stipulated and agreed that this bond shall insure to the benefit of any and all persons, companies and corporations entitled to file claims so as to give a right of action to them or their assigns in any suit brought upon this bond.

Should the conditions of this bond be fully performed then this obligation shall become null and void, otherwise it shall be and remain in full force and effect.

And the said Surety, for value received, hereby stipulates, and agrees that no change, extension of time, alteration or addition to the terms of said Contract or the Specifications accompanying the same shall in any manner affect its obligations of this bond and it does hereby waive notice of any such change, extension, alteration or additions.

IN WITNESS WHEREOF, this instrument has been duly executed by the Principal and the Surety, this _____ day of _____, 20_____.

(To be signed by Principal and Surety and acknowledged and Notarial Seal attached.)

PRINCIPAL

_____
NAME

_____
TITLE

_____
ADDRESS

_____
CITY / STATE / ZIP CODE

_____
TELEPHONE

(PRINCIPAL SEAL)

SURETY

_____
NAME

_____
TITLE

_____
ADDRESS

_____
CITY / STATE / ZIP CODE

_____
TELEPHONE

(SURETY SEAL)

DRUG-FREE WORKPLACE CERTIFICATION

(To be submitted upon Notice of Award)

Project: **COS Student Union**

I, (Name)_____, the (Title)_____ of (Contractor)_____, declare, state and certify to all of the following:

1. I am aware of the provisions and requirements of California Government Code §8350 et seq., the Drug Free Workplace Act of 1990.

2. I am authorized to certify, and do certify, on behalf of Contractor that a drug free workplace will be provided by Contractor by doing all of the following:

A. Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance is prohibited in Contractor's workplace and specifying actions which will be taken against employees for violation of the prohibition.

B. Establishing a drug-free awareness program to inform employees about all of the following:

(i) The dangers of drug abuse in the workplace.

(ii) Contractor's policy of maintaining a drug-free workplace.

(iii) The availability of drug counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations.

C. Requiring that each employee engaged in the performance of the Contract be given a copy of the statement required by subdivision (A), above, and that as a condition of employment by Contractor in connection with the Work of the Contract, the employee agrees to abide by the terms of the statement.

3. Contractor agrees to fulfill and discharge all of Contractor's obligations under the terms and requirements of California Government Code §8355 by, inter alia, publishing a statement notifying employees concerning: (a) the prohibition of any controlled substance in the workplace, (b) establishing a drug-free awareness program, and (c) requiring that each employee engaged in the performance of the Work of the Contract be given a copy of the statement required by California Government Code §8355(a) and requiring that the employee agree to abide by the terms of that statement.

4. Contractor and I understand that if the Owner determines that Contractor has either: (a) made a false certification herein, or (b) violated this certification by failing to carry out and to implement the requirements of California Government Code §8355, the Contract awarded herein is subject to termination, suspension of payments, or both. Contractor and I further understand that, should Contractor violate the terms of the Drug-Free Workplace Act of 1990, Contractor may be subject to debarment in accordance with the provisions of California Government Code §8350, et seq.

5. Contractor and I acknowledge that Contractor and I are aware of the provisions of California Government Code §§8350, et seq. and hereby certify that Contractor and I will adhere to, fulfill, satisfy and discharge all provisions of and obligations under the Drug-Free Workplace Act of 1990.

Executed this _____ day of _____, 20_____ at _____(City/County/State).

I declare under penalty of perjury under the law of the State of California that the foregoing is true and correct.

_____ _____

SIGNATURE PRINTED NAME

ADDRESS / CITY / STATE / ZIP CODE

(_____)_____

PHONE

EXCLUSION OF LEAD PRODUCTS

(To be submitted upon Notice of Award)

Project: **COS Student Union**

Pursuant to the provisions of the California Education Code for construction, modernization, or renovation of school facilities, lead based paint, lead plumbing, and solders, or other potential sources of lead contamination shall not be utilized in the construction of any new school facility or the modernization or renovation of any existing school facility. The Contractor agrees that sources and potential sources of lead contamination, whether in products or materials, will not be used in performing work under the Agreement. At completion of Work under the Agreement, the Contractor will warrant and represent to the Owner the following:

1. No sources or potential sources of lead contamination were used in performing Work under the Agreement.

2. Should any sources or potential sources of lead contamination be found to have been used by the Prime Contractor or any Subcontractor, supplier, or vendor on the Project, the Contractor will replace them, together with all related materials, at no cost to the Owner.

3. Should the replacement require any interruption in the normal operations of the school, the Contractor will pay all costs necessarily incurred to keep the school functioning with the least possible disruption of its day-to-day operations.

Executed this _____ day of _____, 20_____ at _____(City/County/State).

I declare under penalty of perjury under the law of the State of California that the foregoing is true and correct.

_____ _____

SIGNATURE PRINTED NAME

_____

ADDRESS / CITY / STATE / ZIP CODE

(_____)_____

PHONE

GUARANTEE

(To be submitted upon completion of Project)

The undersigned _____ (Contractor) hereby warrants and guarantees that all work, materials, equipment and workmanship provided, furnished or installed by or on behalf of Contractor in connection with the work of improvement described as **COS Student Union** (the "Work") have been provided, furnished and installed in strict conformity with the Contract Documents for the Work, including without limitation, the Drawings and the Specifications. Contractor further warrants and guarantees that all work, materials, equipment, and workmanship as provided, furnished and/or installed are fit for use as specified and fulfill all applicable requirements of the Contract Documents including without limitation, the Drawings and the Specifications. Contractor shall, at its sole cost and expense, repair, correct and/or replace any or all of the work, materials, equipment and/or workmanship of the Work, together with any other items which may be affected by any such repairs, corrections or replacement, that may be unfit for use as specified or defective within a period of **one (1) year** from the recorded date of the Owner's Notice of Completion with the County; ordinary wear and tear and unusual abuse or neglect excepted.

In the event of the Contractor's failure and/or refusal to comply with the provisions of this Guarantee, within the period of time set forth in the Contract Documents after the Owner's issuance of the Notice to the Contractor of any defect(s) in the Work, materials, equipment or workmanship, Contractor authorizes the Owner, without further notice to Contractor, to repair, correct and/or replace any such defective item at the expense of the Contractor. The Contractor shall reimburse the Owner for all costs, expenses or fees incurred by the Owner in providing or performing such repairs, corrections, or replacements within ten (10) days of the Owner's presentation of a demand to the Contractor for the same.

The provisions of this Guarantee and the provisions of the Contract Documents for the Work relating to the Contractor's Guarantee(s) and warranty(ies) relating to the Work shall be binding upon the Contractor's Performance Bond Surety and all successors or assigns of Contractor and/or Contractor's Performance Bond Surety.

The provisions of this Guarantee are in addition to, and not in lieu of, any provisions of the Contract Documents for the Work relating to the Contractor's guarantee(s) and warranty(ies) or any guarantee(s) or warranty(ies) provided by any material supplier or manufacturer of any equipment, materials or other items forming a part of, or incorporated into the Work, or any other guarantee or warranty obligation of the Contractor, prescribed, implied or imposed by law.

The undersigned individual executing this Guarantee on behalf of Contractor warrants and represents that he/she is duly authorized to execute this Guarantee on behalf of Contractor and to bind Contractor to each and every provision hereof.

_____ _____

SIGNATURE DATE

_____ _____

PRINTED NAME TITLE

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GENERAL CONDITIONS

ARTICLE 1: DEFINITIONS; GENERAL

1.1. District. The term "District" shall refer to the SEQUOIAS COMMUNITY COLLEGE DISTRICT unless otherwise stated, references to the "District" in the Contract Documents shall mean the District, the District's authorized representatives, including the Project Manager, if a Project Manager is designated, the District's Board of Trustees and the District's officers, employees, agents and representatives.

1.2. Prime Contractor. The Prime Contractor is the person or entity identified as such in the Agreement; references to "Prime Contractor" in the Contract Documents shall mean the Prime Contractor or the Prime Contractor's authorized representative. Each Prime Contractor shall enter into an Agreement with the District to perform a certain portion or portions of the Work. There may be more than one Prime Contractor under a Multiple Prime - PM project delivery system. Whenever the term "Contractor" in the singular or "Contractors" in the plural is used in this document, it shall refer individually and collectively to one or all of the Prime Contractors, as the context implies.

1.3. Engineer. The Engineer is the person or entity identified as such in the Agreement; references to the "Engineer" in the Contract Documents includes the Engineer's authorized representative, the Engineer's Consultants for the Work, and the Consultants' employees, agents and representatives.

1.4. Project Manager. The Project Manager is an independent contractor retained by the District and is authorized and empowered to act on behalf of the District as set forth in the Contract Documents. The District reserves the right to remove or replace the Project Manager prior to completion of the Work without adjustment of the Contract Price or the Contract Time or otherwise affecting, limiting or restricting Contractor's obligations hereunder. References to the Project Manager in the Contract Documents shall mean the Project Manager or the Project Manager's authorized representative. The Project Manager's duties are to coordinate, expedite, manage, and supervise the Project. The Project Manager will provide an onsite Project Manager whose function is to represent the District in all on site construction matters, and coordinate the work of various individual Prime Contractors. References in the Contract Documents to "Construction Manager" or to "CM" shall be deemed references to the Project Manager. The Architect, Engineer, Project Inspector and/or related project consultants shall also be deemed references to the Project Manager. The District reserves the right to decide whether or not to employ a Project Manager on the Project.

1.5. The Work. The term "Work" shall be deemed to mean the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment or services provided or to be provided by the Prime Contractor to fulfill the Prime Contractor's obligations under the Contract Documents. The Work may constitute the whole or a part of the Project.

1.6. The Project. The Project is the total construction of the Work performed by the Prime Contractor under the Contract Documents which may be the whole or a part of the Project and which may include construction by the District or by separate Contractors to the District.

1.7. Surety. The Surety is the person or entity that executes, as surety, the Contractor's Labor and Material Payment Bond and/or Performance Bond.

1.8. Subcontractors; Sub-Subcontractors. A Subcontractor is a person or entity who has a direct contract with the Prime Contractor to perform a portion of the Work. The term "Subcontractor" does not include a separate Prime Contractor to the District or Subcontractors of any separate contractor. A Sub-Subcontractor is a person or entity of any tier, who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. As required by the context of usage, the term "Subcontractor" shall include Sub-Subcontractors.

1.9. Material Supplier. A Material Supplier is any person or entity who only furnishes materials, equipment or supplies for the Work without fabricating, installing or consuming them in the performance of the Work of the Contract.

1.10. Drawings and Specifications. The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing generally, the design, location and dimensions of the Work and may include without limitation, plans, elevations, sections, details, schedules or diagrams. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, criteria and workmanship for the Work and related services. The Drawings and Specifications are intended to delineate and describe the Work and its component parts so as to permit skilled and competent contractors to bid upon the Work and prosecute the same to completion. Large scale Drawings shall take precedence over smaller scale Drawings as to shape and details of construction. Figured dimensions on Drawings shall govern, but Work which is not dimensioned shall be as directed or required by field conditions. Specifications shall govern as to materials, workmanship and installation procedures.

1.11. Special Conditions. To the extent they are part of the Contract Documents, Special Conditions are special or supplemental provisions, not otherwise provided for in the Agreement or the General Conditions, which apply to the Work.

1.12. Contract Documents. The Contract Documents consist of the Agreement between the District and the Prime Contractor, Conditions of the Contract (whether General, Special, Supplemental or otherwise), Drawings, Specifications, including addenda thereto issued prior to execution of the Agreement and any other documents listed in the Agreement. The Contract Documents shall include modifications issued after execution of the Agreement. The Contract Documents form the Contract for Construction.

1.13. Intent and Correlation of Contract Documents.

1.13.1. Work of the Contract Documents. The intent of the Contract Documents is to

include all items necessary for the proper execution and completion of the Work awarded to the Prime Contractor by the District. The Contract Documents are complementary and what is required by one shall be as binding as if required by all; performance by the Prime Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable there from as being necessary to produce the intended results. Organization of the Specifications into divisions, sections or articles, and the arrangement of Drawings shall not control the Prime Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Where any portion of the Contract Documents is silent and information appears elsewhere in the Contract Documents, such other portions of the Contract Documents shall control.

1.13.2. Technical Terms. Unless otherwise stated in the Contract Documents, words or terms which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

1.13.3. Conflict in Contract Documents. Conflicts, inconsistencies or ambiguities in the Contract Documents shall be resolved by the Engineer in accordance with Article 3.1.9 of the General Conditions; where conflicts or inconsistencies arise between the Drawings and the Specifications, in resolving such conflicts or inconsistencies, the Engineer will be governed generally by the following standards: the Drawings are intended to describe matters relating to placement, type, quantity and the like; the Specifications are intended to describe matters relating to quality, materials, compositions, manufacturers and the like. If conflicts exist between portions of the Contract Documents regarding the quality of any item, product, equipment or materials, unless otherwise directed or authorized by the District, the Contractor shall provide the item, product, equipment or material of the highest or more stringent quality.

1.14. Shop Drawings; Samples; Product Data ("Submittals"). Shop Drawings are diagrams, schedules, and other data specially prepared for the Work by the Prime Contractor or a Subcontractor, Sub-Subcontractor, manufacturer, Material Supplier, or distributor to illustrate some portion of the Work. Samples are physical examples of materials, equipment or workmanship forming a part of, or to be incorporated into the Work. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Prime Contractor to illustrate materials or equipment for some portion of the Work. Shop Drawings, Samples and Product Data prepared or furnished by the Prime Contractor or any of its Subcontractors or Material Suppliers are collectively referred to as "Submittals."

1.15. Division of the State Architect ("DSA"). The DSA is California's Division of the State Architect including without limitation the DSA's Office of Construction Services, Office of Design Services, and the Office of Regulation Services; references to the DSA in the Contract Documents shall mean the DSA, its offices and its authorized employees and agents. The authority of the DSA over the Work and the performance thereof shall be as set forth in the Contract Documents and Title 24 of the California Code of Regulations.

1.16. District's Inspector. The District's Inspector is the individual designated and employed by the District in accordance with the requirements of Title 24 of the California Code of Regulations. The District's Inspector shall be authorized to act on behalf of the District as provided for in the Contract Documents and in Title 24 of the California Code of Regulations, as the same may be amended from time to time. References in the Contact Documents to the "Project Inspector" shall be deemed references to the "District's Inspector."

1.17. Contract Document Terms. As used in the Contract Documents, the term "provide" shall mean "provide complete in place" or to "furnish and install" such item. Unless otherwise provided in the Contract Documents, the terms "approved;" "directed;" "satisfactory;" "accepted;" "acceptable;" "proper;" "required;" "necessary" and "equal" shall mean as approved, directed, satisfactory, accepted, acceptable, proper, required, necessary and equal, in the opinion of the Engineer. The term "typical" as used in the Drawings shall require the installation or furnishing of such item(s) of the Work designated as "typical" in all other similar areas. Work in such other areas shall conform to that shown as "typical" or as reasonably inferable there from.

1.18. Prime Contractor's Superintendent. The Prime Contractor's Superintendent is the individual employed by the Prime Contractor whose principal responsibility shall be the supervision and coordination of the Work; the Prime Contractor's Superintendent shall not perform routine construction labor.

1.19. Record Drawings. The Record Drawings are a set of the Drawings marked by the Prime Contractor during the performance of the Work to indicate completely and accurately the actual as-built condition of the Work. The Record Drawings shall be sufficient for a capable and qualified draftsman to modify the Drawings to reflect and indicate the Work actually in place at Final Completion of the Work.

1.20. Construction Equipment. The term "Construction Equipment" shall be deemed to refer to equipment utilized for the performance of any portion of the Work, but which is not incorporated into the Work.

1.21. Site. The Site is the physical area designated in the Contract Documents for Prime Contractor's performance, construction and installation of the Work.

1.22. Field Clarifications. A written or graphic document consisting of supplementary details, instructions or information issued on behalf of the District which clarifies or supplements the Contract Documents and which becomes a part of the Contract Documents upon issuance. Field Clarifications do not constitute an adjustment of the Contract Time or the Contract Price, unless a Change Order relating to a Field Clarification is authorized and issued under the Contract Documents.

1.23. Defective or Non-Conforming Work. Defective or non-conforming Work is any Work which is unsatisfactory, faulty, incomplete, or deficient by: (a) not conforming to the requirements of the Contract Documents; (b) not conforming to the standards of workmanship of the applicable trade

or industry; (c) not being in compliance with the requirements of any inspection, reference, standard, test, or approval required by the Contract Documents; or (d) damage occurring prior to Final Completion of all of the Work.

1.24. Delivery. The term "delivery" used in conjunction with any equipment, materials or other items to be incorporated into the Work shall mean the unloading and storage in a protected condition pending incorporation into the Work.

1.25. Notice to Proceed. The Notice to Proceed is the written notice issued by or on behalf of the District to the Contractor authorizing the Contractor to proceed with commencement of the Work and which establishes the date for commencement of the Contract Time.

1.26. Progress Reports; Verified Reports. Progress Reports, if required, are written reports prepared by the Contractor and periodically submitted to the District in the form and content as required by the Contract Documents. Verified Reports are periodic written reports prepared by the Contractor and submitted to the DSA; Verified Reports shall be in such form and content as required by the applicable provisions of Title 24 of the California Code of Regulations. A material obligation of the Contractor is the preparation of complete and accurate Progress Reports, if required, and Verified Reports as well as the timely submission of the same.

1.27. Substantial Completion. "Substantial Completion" means the state in the progress of the Work, as determined by the Engineer, when all of the Work is complete and in accordance with the Contract Documents except only for correction of minor items which do not impair the District's ability to occupy and fully utilize the Work for its intended purposes.

1.28. Final Completion. The term "Final Completion" means the Work has been fully completed in accordance with the requirements of the Contract Documents.

1.29. Days. Unless otherwise expressly stated, references to "days" in the Contract documents shall be deemed to be calendar days.

1.30. Laws. The term "Laws" as used in the Contract Documents shall refer to all laws, ordinances, codes, rules and/or regulations promulgated by any governmental or quasi-governmental agency with jurisdiction over any portion of the Work and which apply to any portion of the Work. Laws refer to those enacted and in effect as of the execution of the Agreement, amendments thereto occurring during the performance of the Work, and subsequently enacted Laws which take effect during the performance of the Work. No adjustment of the Contract Time or the Contract Price shall be allowed for the Contractor's compliance with the Laws.

ARTICLE 2: DISTRICT

2.1. Information Required of District.

2.1.1. Surveys; Site Information. Information, if any, concerning physical

characteristics of the Site, including without limitation, surveys, soils reports, and utility locations, to be provided by the District are set forth in the Contract Documents. Information not provided by the District or necessary information in addition to that provided by the District concerning physical characteristics of the site of the Work which is required for Prime Contractor's completion of the Work in accordance with the terms of the Contract Documents shall be obtained by Prime Contractor without adjustment to the Contract Price or the Contract Time.

2.1.2. Permits; Fees. Except as otherwise provided in the Contract Documents, the District shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities which relate to the Work of the Prime Contractor under the Contract Documents. To the extent that permits and fees are designated as the responsibility of the Prime Contractor under the Contract Documents, the Prime Contractor shall be solely responsible for obtaining the same; the cost of such permits or fees and any costs incurred by the Prime Contractor in obtaining such permits shall be included within the Contract Price.

2.1.3. Drawings and Specifications. Except as otherwise provided for in the Contract Documents, the District shall furnish the Prime Contractor, free of charge, the number of copies of the Drawings and the Specifications as set forth in the Special Conditions. All of the Drawings and the Specifications provided by the District to the Prime Contractor remain the property of the District; the Prime Contractor shall not use the Drawings or the Specifications in connection with any other work of improvement other than the Work of the Project.

2.1.4. Furnishing of Information. Information or services to be provided by the District under the Contract Documents shall be furnished by the District with reasonable promptness to avoid delay in the orderly progress of the Work. Information about existing conditions furnished by the District under the Contract Documents is obtained from sources believed to be reliable, but the District neither guarantees nor warrants that such information is complete and accurate. The Prime Contractor shall verify all information provided by the District. To the extent that the Contract Documents depict existing conditions on or about the Site, or the Work involves the renovation, removal or remodeling of existing improvements or the Work involves any tie-in or other connection with any existing improvements, the conditions and/or existing improvements depicted in the Contract Documents are as they are believed to exist. Prime Contractor shall bear the risk of any variations between conditions or existing improvements depicted in the Contract Documents and those conditions or existing improvements actually encountered in the performance of the Work. The existence of any variations between conditions or existing improvements depicted in the Contract Documents and those actually encountered in the performance of the Work shall not result in any District liability therefore, nor shall any such variations result in an adjustment of the Contract Time or the Contract Price.

2.2. District's Right to Stop the Work. In addition to the District's right to suspend the Work or terminate the Contract pursuant to the Contract Documents, the District, may, by written order, direct the Prime Contractor to stop the Work, or any portion thereof, until the cause for such stop work order has been eliminated if the Prime Contractor: (i) fails to correct Work which is not in conformity and in accordance with the requirements of the Contract Documents, or (ii) otherwise fails to carry out the Work in conformity and accordance with the Contract Documents. The right of the District to stop the Work hereunder shall not be deemed a duty on the part of the District to exercise such right for the benefit of the Prime Contractor or any other person or entity, nor shall the District's exercise of such right waive or limit the exercise of any other right or remedy of the District under the Contract Documents or at law.

2.3. Partial Occupancy or Use.

2.3.1. District's Right to Partial Occupancy. The District may occupy or use any completed or partially completed portion of the Work, provided that: (i) the District has obtained the consent of, or is otherwise authorized by, public authorities with jurisdiction thereof, to so occupy or use such portion of the Work and (ii) the District and the Prime Contractor have accepted, in writing, the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, utilities, damage to the Work, insurance and the period for correction of the Work and commencement of warranties required by the Contract Documents for such portion of the Work partially used or occupied by the District. In the event the Prime Contractor and the District are unable to agree upon the matters set forth in (ii) above, the District may nevertheless use or occupy any completed or partially completed portion of the Work, with the responsibility for such matters subject to resolution in accordance with the Contract Documents. Immediately prior to such partial occupancy or use of the Work, or portions thereof, the District, the District's Inspector, the Prime Contractor and the Engineer shall jointly inspect the portions of the Work to be occupied or to be used to determine and record the condition of the Work. Repairs, replacements or other corrective action noted in such inspection shall be promptly performed and completed by the applicable Prime Contractor so that the portion of the Work to be occupied or used by the District is in conformity with the requirements of the Contract Documents and the District's occupancy or use thereof is not impaired. The District's use or occupancy of the Work or portions thereof pursuant to the preceding shall not be deemed "completion" of the as that term is used in Public Contract Code § 7107. "Completion" for purposed of Public Contract Code §7107 shall occur only upon completion of the entirety of the Work of a Bid Package.

2.3.2. No Acceptance of Defective or Nonconforming Work. Unless otherwise expressly agreed upon by the District and the Prime Contractor, the District's partial occupancy or use of the Work or any portion thereof, shall not constitute the District's acceptance of the Work not complying with the requirements of the Contract Documents or which is otherwise defective.

2.4. The District's Inspector. In addition to the authority and rights of the District's Inspector as provided for elsewhere in the Contract Documents, all of the Work shall be performed under the observation of the District's Inspector. The District's Inspector shall have access to all parts of the Work at any time, wherever located and whether partially or completely fabricated, manufactured, furnished or installed. The performance of the duties of the District's Inspector under the Contract Documents shall not relieve or limit the Prime Contractor's performance of its obligations under the Contract Documents.

2.4.1. Access to Work. The Contractor shall provide the Project Inspector with access to all parts of the Work at any time, wherever located and whether partially or completely fabricated, manufactured, furnished or installed. The Project Inspector shall have the authority to stop Work if the Work is not in conformity with the Contract Documents.

2.4.2. Limitations on Project Inspector. The Project Inspector does not have authority to interpret the Contract Documents or to modify the Work depicted in the Contract Documents. No Work inconsistent with the Contract Documents shall be performed solely on the basis of the direction of the Project Inspector, and the Contractor shall be liable to the District for the consequences of all Work performed on such basis.

2.4.3. Compliance with Project Inspector Non-Conforming Notices. If, during the course of the Work, the Project Inspector issues any notice of non-conforming conditions (or other similar notices) in the Work in place or in progress, the Contractor shall immediately thereafter commence and diligently prosecute to completion, without adjustment to the Contract Time or the Contract Price, repairs, replacement or other corrections of such conditions. The District may, at the District's sole and exclusive discretion, withhold any portion of the Contract Price then or thereafter due the Contractor in an amount reasonably reflecting the anticipated costs to complete repairs, replacement or other corrections to the Work determined by the Project Inspector not be to in conformity with the Contract Documents. Without waiver or limitation of any other right or remedy of the District, the District may, after notice to the Contractor of the Contractor's failure to immediately commence and diligently prosecute to completion such actions as necessary to comply with any such notice issued by the Project Inspector, cause such corrective, remedial or other actions necessary to comply with any such notice. In such event, all costs, fees and expenses incurred by the District to cause such corrective, remedial and other actions to be undertaken and completed shall be the sole responsibility of the Contractor; the District may deduct such costs, fees or expenses from any portion of the Contract Price then or thereafter due the Contractor.

ARTICLE 3: ENGINEER

3.1. Engineer's Administration of the Contract.

3.1.1. Administration of Contract. The Engineer will provide administration of the Contract as described in the Contract Documents and will be one of the District's representatives during construction until the time that Final Payment is due the Prime Contractor under the Contract Documents. The Engineer will advise and consult with the District, the Project Manager and the District's Inspector with respect to the administration of the Contract and the Work. The Engineer is authorized to act on behalf of the District to the extent provided for in the Contract Documents; and shall have the responsibilities and powers established by law, including Title 24 of the California Code of Regulations.

3.1.2. Periodic Site Inspections. The Engineer will visit the Site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine, in general, if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. The Engineer will not be required to make exhaustive or continuous Site inspections to check quality or quantity of the Work. On the basis of Site observations as an Engineer, the Engineer will keep the District informed of the progress of the Work, and will endeavor to guard the District against defects and deficiencies in the Work.

3.1.3. Prime Contractor Responsibility for Construction Means, Methods and Sequences. Each Prime Contractor shall be fully responsible for the construction means, methods, techniques, procedures and sequences necessary and appropriate to fully complete in a workmanlike manner of good quality free from defects and on time all of the work awarded to the Prime Contractor by District. The Engineer will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, these being solely the Prime Contractor's responsibility. The Engineer will not have control over or charge of and will not be responsible for acts or omissions of the Prime Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

3.1.4. Verification of Applications for Payment. In accordance with Article 8 hereof, the Engineer will review the Prime Contractor's Applications for Progress Payments and for Final Payment, verify the extent of Work performed and the amount properly due the Prime Contractor on such Application for Payment.

3.1.5. Rejection of Work. The Engineer is authorized to reject Work which is defective or does not conform to the requirements of the Contract Documents. Whenever the Engineer considers it necessary or advisable, for implementation of the intent

of the Contract Documents, the Engineer will have authority to require additional inspections or testing of the Work, whether or not such Work is fabricated, installed or completed.

3.1.6. Submittals.

3.1.6.1. Engineer of Record's Review. The Engineer will review and approve or take other appropriate action upon the Prime Contractor's Submittals, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of Submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Prime Contractor as required by the Contract Documents. The Engineer's review of the Prime Contractor's Submittals shall not relieve the Prime Contractor of its obligations under the Contract Documents. The Engineer's review of Submittals shall not constitute approval of safety measures, programs or precautions or, unless otherwise specifically stated by the Engineer, of any construction means, methods, techniques, sequences or procedures. The Engineer's approval of a specific item in a Submittal shall not indicate approval of an assembly of which the item is a component with the Submittal(s) required and relating to such assembly have been reviewed by the Engineer.

3.1.6.2. Time for Engineer's Review. The Engineer's review of Submittals will be conducted promptly so as not to delay or hinder the progress of the Work or the activities of the Prime Contractor, the District or the District's separate Prime Contractors while allowing sufficient time, in the Engineer's reasonable professional judgment, to permit adequate review of Submittals. The foregoing notwithstanding, the Engineer's review and return of Submittals will conform with the time limits and other conditions, if any, set forth in the Specifications or Submittal Schedule if the Submittal Schedule is required by the other provisions of the Contract Documents.

3.1.7. Changes to the Work; Change Orders. The Engineer will prepare Change Orders, and may authorize minor Changes in the Work in accordance with Article 9.9 hereof.

3.1.8. Completion. The Engineer will conduct observations to determine the date or dates of Substantial Completion and the date of Final Completion, will receive and forward to the District, for the District's review and records, written

warranties and related documents required by the Contract Documents and assembled by the Prime Contractor, and will verify that the Prime Contractor has complied with all requirements of the Contract Documents and is entitled to receipt of Final Payment.

3.1.9. Interpretation of Contract Documents; Engineer as Initial Arbiter of Disputes.

3.1.9.1. Authority of Engineer. The Engineer will interpret and decide matters concerning the requirements of the Contract Documents on written request of either the District or the Prime Contractor. The Engineer's response to such requests will be made with reasonable promptness and within the time limits agreed upon, if any. If no agreement is reached establishing the time for the Engineer's review and response to requests under this Article 3.1.9, the Engineer shall be afforded a fifteen (15) day period after receipt of such request to review and respond thereto. Interpretations and decisions of the Engineer will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Engineer will endeavor to secure faithful performance by both the District and the Prime Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith. The Engineer's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents. If there is any disagreement, dispute or other matter in controversy between the District and the Contractor, in addition to other requirements established by the Contract Documents or by law, the submission of the same to the Engineer for its decision shall be a condition precedent to initiation of dispute resolution procedures.

3.1.9.2. Request for Information. In the event that the Prime Contractor shall encounter any condition which the Prime Contractor believes, in good faith and with reasonable basis, is the result of an ambiguity, conflict, error or omission in the Contract Documents (collectively "the Conditions"), it shall be the affirmative obligation of the Prime Contractor to timely notify the Engineer, in writing, of the Conditions encountered and to request information from the Engineer necessary to address and resolve any such Conditions before proceeding with any portion of the Work affected or which may be affected by such Conditions. In the event that the Prime Contractor shall fail to so timely notify the Engineer in writing of any Conditions encountered and the Prime Contractor proceeds to perform any portion of the Work containing or affected by such Conditions the Prime Contractor shall bear all costs associated with or required to correct, remove, or otherwise remedy any portion of the Work affected thereby without

adjustment of the Contract Time or the Contract Price. In requesting information of the Engineer to address and resolve any Conditions the Prime Contractor shall act with promptness in submitting any such written request so as to allow the Engineer a reasonable period of time to review, evaluate and respond to any such request, taking into account the then current status of the progress and completion of the Work and the actual or potential impact of any such Conditions upon the completion of the Work within the Contract Time. The Contract Time shall not be subject to adjustment in the event that the Prime Contractor shall fail to timely request information from the Engineer. The Engineer's responses to any such Prime Contractor request for information shall conform with the standards and time frame set forth in Article 3.1.9.1 of these General Conditions. The foregoing provisions notwithstanding, in the event that the Engineer reasonably determines that any of Prime Contractor's request(s) for information pursuant to this Article 3.1.9.2: (i) do not reflect adequate or competent supervision or coordination by the Prime Contractor or any Subcontractor; or (ii) do not reflect the Prime Contractor's adequate or competent knowledge of the requirements of the Work or the Contract Documents; or (iii) is not justified for any other reason, Prime Contractor shall be liable to the District for all costs incurred by the District associated with the processing, reviewing, evaluating and responding to any such request for information, including without limitation, fees of the Engineer and any other design consultant to the Engineer or the District. In responding to any of Prime Contractor's request(s) for information, the Engineer shall, in the response, indicate if the Engineer has made the determination pursuant to the preceding sentence and, if so, the amount of costs to be borne by the Prime Contractor for the processing, review, evaluation and response to the request for information. Thereafter, the District shall be authorized to deduct such amount from any portion of the Contract Price then or thereafter due the Prime Contractor.

3.2. Communications; Project Manager and Engineer's Role. All communications regarding the Work, the performance thereof or the Contract Documents shall be in writing; verbal communications shall be reduced to writing. Communications between the Prime Contractor and the District shall be through the Project Manager. All written communications between separate contractors, if any, shall be through the Project Manager. All written communications between the Prime Contractor and any Subcontractor, Material Supplier or others directly or indirectly engaged by the Prime Contractor to perform or provide any portion of the Work shall be available to the District, the Project Manager and the Engineer for review, inspection and reproduction as may be requested from time to time. Failure or refusal of the Prime Contractor to permit the District, the Project Manager or Engineer to review, inspect or reproduce such written communications may be deemed a default of Prime Contractor hereunder.

3.3. Termination of Engineer or Project Manager; Substitute Engineer or Project Manager. In case of termination of employment of the Engineer, the District shall appoint a substitute Engineer whose status under the Contract Documents shall be that of the Engineer.

ARTICLE 4: THE PRIME CONTRACTOR

4.1. Prime Contractor Review of Contract Documents.

4.1.1. Examination of Contract Documents. The Prime Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the District pursuant to the Contract Documents and shall at once report to the Project Manager and Engineer any errors, inconsistencies or omissions discovered. If the Prime Contractor performs any Work knowing, or what with reasonable diligence it should have discovered or known, that such Work involves an error, inconsistency or omission in the Contract Documents without prior notice to the Project Manager and Engineer of the same, the Prime Contractor shall assume full responsibility for such performance and shall bear all attributable costs for correction of the same.

4.1.2. Field Measurements. Prior to commencement of the Work, or portions thereof, the Prime Contractor shall take field measurements and verify field conditions at the Site and shall carefully compare such field measurements and conditions and other information known to the Prime Contractor with information provided in the Contract Documents. Errors, inconsistencies or omissions discovered shall be reported to the Engineer at once.

4.1.3. Dimensions; Layouts and Field Engineering. Dimensions indicated in the Drawings are intended for reference only. The Drawings are intended to be diagrammatic and schematic in nature; the Prime Contractor shall be solely responsible for dimensioning and coordinating the Work of the Contract Documents. All field engineering required for laying out the Work and establishing grades for earthwork operations shall be by the Prime Contractor at its expense. Any field engineering or other engineering to be provided or performed by the Prime Contractor under the Contract Documents and required or necessary for the proper execution or installation of the Work shall be provided and performed by the an engineer duly registered under the laws of the State of California in the engineering discipline for such portion of the Work.

4.1.4. Work in Accordance With Contract Documents. The Prime Contractor shall perform all of the Work in strict conformity with the Contract Documents and approved Submittals.

4.2. Site Investigation; Subsurface Conditions.

4.2.1. Prime Contractor Investigation. The Prime Contractor shall be responsible for, and by executing the Agreement acknowledges, that it has carefully examined the Site and has taken all steps it deems reasonably necessary to ascertain all conditions which may affect the Work, or the cost thereof, including, without limitation, conditions bearing upon transportation, disposal, handling or storage of materials; availability of labor or utilities; access to the Site; and the physical conditions and the character of equipment, materials, labor and services necessary to perform the Work. Any failure of the Prime Contractor to do so will not relieve it from the responsibility for fully and completely performing all Work without adjustment to the Contract Price or the Contract Time. The District assumes no responsibility to the Prime Contractor for any understandings or representations concerning conditions or characteristics of the Site, or the Work, made by any of its officers, employees or agents prior to the execution of the Agreement, unless such understandings or representations are expressly set forth in the Agreement.

4.2.2. Subsurface Data. By executing the Agreement, the Prime Contractor acknowledges that it has examined the boring data and other subsurface data available and satisfied itself as to the character, quality and quantity of surface and subsurface materials, including without limitation, obstacles which may be encountered in performance of the Work, insofar as this information is reasonably ascertainable from an inspection of the Site, review of available subsurface data and analysis of information furnished by the District under the Contract Documents. Subsurface data or other soils investigation report provided by the District hereunder are not a part of the Contract Documents. Information contained in such data or report regarding subsurface conditions, elevations of existing grades or below grade elevations are approximate only and are neither guaranteed nor warranted by the District to be complete and accurate. The Prime Contractor shall examine all boring and other subsurface data to make its own independent interpretation of the subsurface conditions and acknowledges that its bid is based upon its own opinion of the conditions which may be encountered. The District assumes no responsibility for any conclusions or interpretations made by Prime Contractor on the basis of available subsurface data or other information furnished by District under the Contract Documents.

4.2.3. Subsurface Conditions. If the Work under the Contract Documents involves digging trenches or other excavations that extend deeper than four feet below the surface, the Prime Contractor sha1l promptly and before the following conditions are disturbed, notify the District's Inspector, in writing, of any: (i) material that the Prime Contractor believes may be material that is hazardous waste, as defined in California Health and Safety Code §25117, that is required to be removed to a Class I or Class II or Class ill disposal site in accordance with provisions of existing law; (ii) subsurface or latent physical conditions at the site differing from those indicated; or (iii) unknown physical conditions at the site of any unusual

nature, different materially from those ordinarily encountered and generally recognized as inherent in the Work or the character provided for in the Contract Documents. If upon notice to the District of the conditions described above and upon the District's investigation thereof, the District determines that the conditions so materially differ or involve such hazardous materials which require an adjustment to the Contract Price or the Contract Time, the District shall issue a Change Order in accordance with Article 9 hereof. In accordance with California Public Contract Code §7104, any dispute arising between the Prime Contractor and the District as to any of the conditions listed in (i), (ii) or (iii) above, shall not excuse the Prime Contractor from the completion of the Work within the Contract Time and the Prime Contractor shall proceed with all Work to be performed under the Contract Documents. The District reserves the right to terminate the Contract pursuant to Article 15.2 hereof should the District determine not to proceed because of any condition described in (i), (ii) or (iii) above.

4.3. Supervision and Construction Procedures.

4.3.1. Supervision of the Work. Each Prime Contractor shall supervise and direct performance of its own Work in accordance with the Master Schedule prepared by the Project Manager, using the Prime Contractor's best skill and attention. The Prime Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract Documents, without interference with, disruption of, or delay to the work of other Contractors working on the Project, unless Contract Documents give other specific instructions concerning these matters. The Prime Contractor shall be responsible for inspection of portions of Work already performed under the Contract Documents to determine that such portions are in proper condition to receive subsequent Work.

4.3.2. Responsibility for the Work; Coordination of the Work. The Prime Contractor shall be responsible to the District for acts and omissions of the Prime Contractor's employees, Subcontractors and their agents and employees, and all other persons performing any portion of the Work under a contract with the Prime Contractor. The Prime Contractor shall not be relieved of the obligation to perform the Work in accordance with the Contract Documents either by activities or duties of the Project Manager, District's Inspector or the Engineer in the Engineer's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Prime Contractor. The Prime Contractor shall be responsible for all necessary or appropriate coordination of the Work and component parts thereof so that Substantial Completion of the Work will be achieved within the Contract Time and the Work will be completed for the Contract Price. The coordination of the Work is a material obligation of the Prime Contractor hereunder and shall include without limitation, conducting regular coordination meetings with its Subcontractors and Material Suppliers,

sequencing the operations of Subcontractors and Material Suppliers, and adapting its planned means, methods and sequences of construction operations as necessary to accommodate field or changed conditions at the Site.

4.3.3. Surveys. The Prime Contractor shall prepare or cause to be prepared all detailed surveys necessary for performance of the Work, including without limitation, slope stakes, points, lines and elevations. The Prime Contractor shall be responsible for the establishment, location, maintenance and preservation of benchmarks, reference points and stakes for the Work. The cost of any surveys and the establishment, location, maintenance and preservation of benchmarks, reference points and stakes shall be included within the Contract Price. The Prime Contractor shall be solely responsible for all loss or costs resulting from the loss, destruction, disturbance or damage of benchmarks, reference points or stakes.

4.3.4. Construction Utilities. The Prime Contractor shall arrange for the furnishing of and shall pay the costs of all utility services, including, without limitation, electricity, water, gas and telephone necessary for performance of the Work and the Prime Contractor's obligations under the Contract Documents. The Prime Contractor shall furnish and install necessary or appropriate temporary distributions of utilities, including meters, to the Site. Any such temporary distributions shall be removed by the Prime Contractor upon completion of the Work. The costs of all such utility services, including the installation and removal of temporary distributions thereof, shall be done by the Prime Contractor and included in the Contract Price.

4.3.5. Existing Utilities; Removal, Relocation and Protection. In accordance with California Government Code §42l5, the District shall assume the responsibility for the timely removal, relocation, or protection of existing main or trunk line utility facilities located on the Site which are not identified in the Drawings, Specifications or other Contract Documents. Prime Contractor shall be compensated for the costs of locating, repairing damage not due to the Prime Contractor's failure to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Drawings, Specifications and other Contract Documents with reasonable accuracy and for equipment on the Site necessarily idled during such work. Prime Contractor shall not be assessed Liquidated Damages for delay in completion of the Work when such delay is caused by the failure of the District or of the utility to provide for removal or relocation of such utility facilities. Nothing in this Article 4.3.5 shall be deemed to require the District to indicate the presence of existing service laterals or appurtenances whenever the presence of such utilities on the Site can be inferred from the presence of other visible facilities, such as buildings, meters and junction boxes, on or adjacent to the Site. In the event that Prime Contractor, in performing the Work, shall encounter utility facilities not identified by the District in the Drawings, Specifications, or other Contract Documents, the Prime Contractor shall immediately notify, in writing, the District, the District's inspector, the

Engineer, the Project Manager and the utility. In the event that such utility facilities are owned by a public utility, the public utility shall have the sole discretion to perform repairs or relocation work or permit the Prime Contractor to do such repairs or relocation work at a reasonable price.

4.4. Labor and Materials.

4.4.1. Payment for Labor, Materials and Services. Unless otherwise provided in the Contract Documents, the Prime Contractor shall provide and pay for labor, materials, equipment, tools, Construction Equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

4.4.2. Employee Discipline. The Prime Contractor shall enforce strict discipline and good order among the Prime Contractor's employees, the employees of any Subcontractor or Sub-subcontractor, and all other persons performing any part of the Work at the Site. The Prime Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. The Prime Contractor shall dismiss from its employ and direct any Subcontractor or Sub-subcontractor to dismiss from their employment any person deemed by the District to be unfit or incompetent to perform Work and thereafter, the Prime Contractor shall not employ nor permit the employment of such person for performance of any part of the Work without the prior written consent of the District, which consent may be withheld in the reasonable discretion of the District.

4.4.3. Prime Contractor's Superintendent. The Prime Contractor shall employ a competent superintendent and all necessary assistants who shall be in attendance at the Site at all times during performance of the Work. The Prime Contractor's communications relating to the Work or the Contract Documents shall be through the Prime Contractor's superintendent. The superintendent shall represent the Prime Contractor and communications given to the superintendent shall be binding as if given to the Prime Contractor. The Prime Contractor shall dismiss the superintendent or any of his/her assistants if they are deemed, in the sole reasonable judgment of the District, to be unfit, incompetent or incapable of performing the functions assigned to them. In such event, the District shall have the right to approve of the replacement superintendent or assistant.

4.4.4. Prohibition on Harassment.

4.4.4.1. District's Policy Prohibiting Harassment. The District is committed to providing a campus and workplace free of sexual harassment and harassment based on factors such as race, color religion, national origin, ancestry, age, medical condition, marital status, disability or veteran status. Harassment includes without limitation, verbal,

physical or visual conduct which creates an intimidating, offensive or hostile environment such as racial slurs; ethnic jokes; posting of offensive statements, posters or cartoons or similar conduct. Sexual harassment includes without limitation the solicitation of sexual favors, unwelcome sexual advances, or other verbal, visual or physical conduct of a sexual nature.

4.4.4.2. Prime Contractor's Adoption of Anti-Harassment Policy. Prime Contractor shall adopt and implement all appropriate and necessary policies prohibiting any form of discrimination in the workplace, including without limitation harassment on the basis of any classification protected under local, state or federal law, regulation or policy. Prime Contractor shall take all reasonable steps to prevent harassment from occurring, including without limitation affirmatively raising the subject of harassment among its employees, expressing strong disapproval of any form of harassment, developing appropriate sanctions, informing employees of their right to raise and how to raise the issue of harassment and informing complainants of the outcome of an investigation into a harassment claim. Prime Contractor shall require that any Subcontractor or Sub-subcontractor performing any portion of the Work to adopt and implement policies in conformity with this Article 4.4.4.

4.4.4.3. Prohibition on Harassment at the Site. Prime Contractor shall not permit any person, whether employed by Prime Contractor, a Subcontractor, Sub-subcontractor, or any other person or entity, performing any portion of the Work at or about the Site to engage in any prohibited form of harassment. Any such person engaging in a prohibited form of harassment directed to any individual performing or providing any portion of the Work at or about the Site shall be subject to appropriate sanctions in accordance with the anti-harassment policy adopted and implemented pursuant to Article 4.4.4.2 above. Any person, performing or providing Work on or about the Site engaging in a prohibited form of harassment directed to any student, faculty member or staff of the District or directed to any other person on or about the Site shall be subject to immediate removal and shall be prohibited thereafter from providing or performing any portion of the Work. Upon the District's receipt of any notice or complaint that any person employed directly or indirectly by Prime Contractor in performing or providing the Work has engaged in a prohibited form of harassment, the District will promptly undertake an investigation of such notice or complaint. In the event that the District, after such investigation, reasonably determines that a prohibited form of harassment has occurred, the District shall promptly notify the Prime Contractor of the same and direct that the person engaging in such conduct be immediately removed from the

Site. Unless the District's determination that a prohibited form of harassment has occurred is grossly negligent or without reasonable cause, District shall have no liability for directing the removal of any person determined to have engaged in a prohibited form of harassment nor shall the Contract Price or the Contract Time be adjusted on account thereof. Prime Contractor and the Surety shall defend, indemnify and hold harmless the District and its employees, officers, board of trustees, agents, and representatives from any and all claims, liabilities, judgments, awards, actions or causes of actions, including without limitation, attorneys' fees, which arise out of, or pertain in any manner to: (i) the assertion by any person dismissed from performing or providing work at the direction of the District pursuant to this Article 4.4.4.3; or (ii) the assertion by any person that any person directly or indirectly under the employment or direction of the Prime Contractor has engaged in a prohibited form of harassment directed to or affecting such person. The obligations of the Prime Contractor and the Surety under the preceding sentence shall be in addition to, and not in lieu of, any other obligation of defense, indemnity and hold harmless whether arising under the Contract Documents, at law or otherwise; these obligations shall survive the completion of the Work or the termination of the Contract.

4.5. Taxes. The Prime Contractor shall pay, without adjustment of the Contract Price, all sales, consumer, use and other taxes for the Work or portions thereof provided by the Prime Contractor under the Contract Documents.

4.6. Permits, Fees and Notices; Compliance with Laws.

4.6.1. Payment of Permits, Fees. Unless otherwise provided in the Contract Documents, the Project Manager shall secure and pay for the building permits, other permits, governmental fees, licenses and inspections necessary or required for the proper execution and completion of the Work.

4.6.2. Compliance with Laws. The Prime Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and other orders of public authorities bearing on performance of the Work.

4.6.3. Notice of Variation from Laws. If the Prime Contractor knows, or has reason to believe, that any portion of the Contract Documents are at variance with applicable laws, statutes, ordinances, building codes, regulations or rules, the Prime Contractor shall promptly notify the Engineer and the District's Inspector, in writing, of the same. If the Prime Contractor performs Work knowing, or with reasonable diligence should have known, it to be contrary to laws, statutes, ordinances, building codes, rules or regulations applicable to the Work without such notice to the Engineer and the District's Inspector, the Prime Contractor shall

assume full responsibility for such Work and shall bear the attributable costs arising or associated there from, including without limitation, the removal, replacement or correction of the same.

4.7. Submittals.

4.7.1. Purpose of Submittals. Shop Drawings, Product Data, Samples and similar submittals (collectively "Submittals") are not Contract Documents. The purpose for submission of Submittals is to demonstrate, for those portions of the Work for which Submittals are required, the manner in which the Prime Contractor proposes to provide or incorporate such item of the Work in conformity with the information given and the design concept expressed in the Contract Documents.

4.7.2. Prime Contractor's Submittals.

4.7.2.1. Prompt Submittals. The Prime Contractor shall review, approve and submit to the Project Manager and Engineer or such other person or entity designated by the District, the number of copies of Submittals required by the Contract Documents. All Submittals required by the Contract Documents shall be prepared, assembled and submitted by the Prime Contractor to the Engineer within the time frames set forth in the Submittal Schedule incorporated and made a part of the Master Schedule prepared by the Project Manager and as specified in Article 7 of these General Conditions. Prime Contractor's submission of Submittals in conformity with the Submittal Schedule is a material consideration of the Contract. In the event of Prime Contractor's failure or refusal to deliver Submittals to the Engineer in accordance with the Submittal Schedule, the Prime Contractor shall be subject to per diem assessments in the amount set forth in the Special Conditions for each day of delayed submission for any Submittal beyond the date set forth in the Submittal Schedule for Prime Contractor's submission of such Submittal. Prime Contractor and District acknowledge and agree that if Prime Contractor shall fail to deliver Submittals in accordance with the Submittal Schedule, the District will incur costs and expenses not contemplated by the Contract Documents, the exact amount of which are difficult to ascertain and fix. Prime Contractor and the District acknowledge and agree that the per diem assessment for delayed submission of Submittals set forth in the Special Conditions represents a reasonable estimate of costs and expenses the District will incur as a result of delayed submission of Submittals and that the same is not a penalty. Notwithstanding Prime Contractor's submission of all required Submittals in accordance with the Submittal Schedule, in the event that the District or the Engineer reasonably determines that all or any portion of such Submittals fail to comply with the requirements of Articles 4.7.2.2, 4.7.2.3 and 4.7.2.4 of these General Conditions and/or

such Submittals are not otherwise complete and accurate so as to require re-submission, Prime Contractor shall bear all costs associated with the review and approval of resubmitted Submittals, including without limitation Engineer's fees incurred in connection therewith; provided that such costs are in addition to, and not in lieu of, any per diem assessments imposed under this Article 4.7.2.1 for Prime Contractor's delayed submission of Submittals. In the event of the District's imposition of the per diem assessments due to the Prime Contractor's delayed submission of Submittals or in the event of the District's assessment of costs and expenses incurred to review incomplete or inaccurate Submittals, the District may deduct the same from any portion of the Contract Price then or thereafter due the Prime Contractor. Submittals not required by the Contract Documents or which do not otherwise conform to the requirements of the Contract Documents may be returned without action. No adjustment to the Contract Time or the Contract Price shall be granted to the Prime Contractor on account of its failure to make timely submission of any Submittal.

4.7.2.2. Approval of Subcontractor Submittals. All Submittals prepared by Subcontractors, of any tier, Material Suppliers, manufacturers or distributors shall bear the written approval of the Prime Contractor thereto prior to submission to the Engineer for review. Any Submittal not bearing the Prime Contractor's written approval shall be subject to return to the Prime Contractor for re-submittal in conformity herewith, with the same being deemed to not have been submitted. Any delay, impact or cost associated therewith shall be the sole and exclusive responsibility of the Prime Contractor without adjustment to the Contract Time or the Contract Price.

4.7.2.3. Verification of Submittal Information. By approving and submission of Submittals, the Prime Contractor represents to the District and Engineer that the Prime Contractor has determined and verified materials, field measurements, field construction criteria, catalog numbers and similar data related thereto and has checked and coordinated the information contained within such Submittals with the requirements of the Work and of the Contract Documents.

4.7.2.4. Information Included in Submittals. All Submittals shall be accompanied by a written transmittal or other writing by the Prime Contractor providing an identification of the portion of the Drawings or the Specifications pertaining to the Submittal, with each Submittal numbered consecutively for ease of reference along with the following information: (i) date of submission; (ii) project name; (iii) name of submitting Subcontractor; and (iv) if applicable, the revision number. The foregoing information is in addition to, and not in lieu of, any

other information required for the Engineer's review, evaluation and approval of the Prime Contractor's Submittals.

4.7.2.5. Prime Contractor Responsibility for Deviations. The Prime Contractor shall not be relieved of responsibility for correcting deviations from the requirements of the Contract Documents by the Engineer's approval of Submittals unless the Prime Contractor has specifically informed the Engineer in writing of such deviation at the time of submission of the Submittal and the Engineer has given written approval to the specific deviation. The Prime Contractor shall not be relieved of responsibility for errors or omissions in Submittals by the Engineer's approval thereof.

4.7.2.6. No Performance of Work without Approval. The Prime Contractor shall perform no portion of the Work requiring the Engineer's review and approval of Submittals until the Engineer has completed its review and granted its approval of such Submittal. The Prime Contractor shall not perform any portion of the Work forming a part of a Submittal or which is affected by a related Submittal until the entirety of the Submittal or other related Submittal has been fully approved. Such Work shall be in accordance with approved Submittals and other applicable portions of the Contract Documents.

4.7.3. Engineer Review of Submittals. The purpose of the Engineer's review of Submittals and the time for the Engineer's return of Submittals to the Prime Contractor shall be as set forth elsewhere in the Contract Documents, including without limitation, Article 3.1.6 of the General Conditions. If the Engineer returns a Submittal as rejected or requiring correction(s) and re-submission, the Prime Contractor, so as not to delay the progress of the Work, shall promptly thereafter resubmit a Submittal conforming to the requirements of the Contract Documents; the resubmitted Submittal shall indicate the portions thereof modified in order to obtain the Engineer's approval. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Engineer shall be entitled to rely upon the accuracy and completeness of such calculations and certifications accompanying Submittals. The Engineer's review of the Submittals is for the limited purposes described in the Contract Documents.

4.7.4. Deferred Approval Items. In the event that any portion of the Work is designated in the Contract Documents as a "Deferred Approval" item, Prime Contractor shall be solely and exclusively responsible for the preparation of Submittals for such item(s) and obtaining approval(s) thereof in a timely manner so as not to delay or hinder the completion of the Work within the Contract Time. Neither the Contract Time nor the Contract Price shall be subject to adjustment on account of the activities of the Prime in preparing submittals for Deferred Approval Items and obtaining approvals thereof.

4.8. Materials and Equipment.

4.8.1. Specified Materials, Equipment. References in the Contract Documents to any specific article, device, equipment, product, material, fixture, patented process, form, method or type of construction, by name, make, trade name, or catalog number, with or without the words "or equal" shall be deemed to establish a minimum standard of quality or performance, and shall not be construed as limiting competition.

4.8.2. Substitutions. Pursuant to Public Contract Code §3400, the District has established an opportunity for the District's consideration of proposed substitutions of materials, equipment and other products designated in the Contract Documents ("Specified Project Items") during the bidding process. In accordance with Public Contract Code §3400, the District will not consider any proposed substitutions for Specified Project Items, except during the bidding process and in accordance with the process set forth in the Instructions for Bidders. If, during the bidding process, a request to furnish and install a substitution for any Specified Project Items was granted by the District, the Contractor may furnish and install either the Specified Project Items or the substitution(s) accepted by the District. Neither the Contract Time nor the Contract Price shall be increased on account of any substitution or alternative proposed by the Contractor and which is approved by the Engineer; provided, however, that in the event a substitution or alternative is approved by the Engineer and purchase, fabrication and/or installation or such approved substitution or alternative shall be less expensive than the originally specified item, the Contract Price shall be reduced by the actual cost savings realized by the Contractor's furnishing and/or installation of such approved substitution or alternative. The Contractor shall likewise be solely responsible for any increase in the cost of any approved substitution or alternative or any Work affected by such alternative or substitution.

4.8.3. Placement of Material and Equipment Orders. Prime Contractor shall, after award of the Contract, promptly and timely place all orders for materials and/or equipment necessary for completion of the Work so that delivery of the same shall be made without delay or interruption to the timely completion of the Work. Prime Contractor shall require that any Subcontractor or Sub-Subcontractor performing any portion of the Work similarly place orders for all materials and/or equipment to be furnished by any such Subcontractor or Sub-Subcontractor in a prompt and timely manner so that delivery of the same shall be made without delay or interruption to the timely completion of the Work. Upon request of the Engineer, the Prime Contractor shall furnish reasonably satisfactory written evidence of the placement of orders for materials and/or equipment necessary for completion of the Work, including without limitation, orders for materials and/or equipment to be provided, furnished or installed by any Subcontractor or Sub-Subcontractor.

4.8.4. District's Right to Place Orders for Materials and/or Equipment. Notwithstanding any other provision of the Contract Documents, in the event that the Prime Contractor shall, upon request of the Engineer, fail or refuse, for any reason, to provide reasonably satisfactory written evidence of the placement of orders for materials and/or equipment necessary for completion of the Work, or should the District determine, in its sole and reasonable discretion, that any orders for materials and/or equipment have not been placed in a manner so that such materials and/or equipment will be delivered to the Site so the Work can be completed without delay or interruption, the District shall have the right, but not the obligation, to place such orders on behalf of the Prime Contractor. In the event that the District shall exercise the right to place orders for materials and/or equipment pursuant to the foregoing, the District's conduct in that regard shall not be deemed to be an exercise, by the District, of any control over the means, methods, techniques, sequences or procedures for completion of the Work, all of which remain the responsibility and obligation of the Prime Contractor pursuant to Article 4.3.1 hereof. Notwithstanding the right of the District to place orders for materials and/or equipment pursuant to the foregoing, the election of the District to exercise, or not to exercise, such right shall not relieve the Prime Contractor from any of Prime Contractor's obligations under the Contract Documents, including without limitation, completion of the Work within the Contract Time and for the Contract Price. In the event that the District shall exercise the right hereunder to place orders for materials and/or equipment on behalf of Prime Contractor pursuant to the foregoing, Prime Contractor shall reimburse the District for all costs and fees incurred by the District in placing such orders; such costs and fees may be deducted by the District from any portion of the Contract Price then or thereafter due the Prime Contractor.

4.9. Safety.

4.9.1. Safety Programs. The Prime Contractor shall be solely responsible for initiating, maintaining and supervising all safety programs required by applicable law, ordinance, regulation or governmental orders in connection with the performance of the Contract, or otherwise required by the type or nature of the Work. The Prime Contractor's safety program shall include all actions and programs necessary for compliance with California or federally statutorily mandated workplace safety programs, including without limitation, compliance with the California Drug Free Workplace Act of 1990 (California Government Code §8350 et seq.). Without limiting or relieving the Prime Contractor of its obligations hereunder, the Prime Contractor shall require that its Subcontractors similarly initiate and maintain all appropriate or required safety programs.

4.9.2. Safety Precautions. The Prime Contractor shall be solely responsible for initiating and maintaining reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (i) employees on the Work and other persons who may be affected thereby; (ii) the Work and materials and equipment to be incorporated therein, whether in storage on or off the site,

under care, custody or control of the Prime Contractor or the Prime Contractor's Subcontractors or Sub-subcontractors; and (iii) other property or items at the site of the Work, or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

4.9.3. Safety Signs, Barricades. The Prime Contractor shall erect and maintain, as required by existing conditions and conditions resulting from performance of the Contract, reasonable safeguards for safety and protection of property and persons, including, without limitation, posting danger signs and other warnings against hazards, promulgating safety regulations and notifying Districts and users of adjacent sites and utilities.

4.9.4. Safety Notices. The Prime Contractor shall give or post all notices required by applicable law and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

4.9.5. Safety Coordinator. The Prime Contractor shall designate a responsible member of the Prime Contractor's organization at the Site whose duty shall be the prevention of accidents and the implementation and maintenance of safety precautions and programs. This person shall be the Prime Contractor's superintendent unless otherwise designated by the Prime Contractor in writing to the District's Inspector and the Engineer.

4.9.6. Emergencies. In an emergency affecting safety of persons or property, the Prime Contractor shall act, at the Prime Contractor's discretion, to prevent threatened damage, injury or loss.

4.9.7. Hazardous Materials.

4.9.7.1. Use of Hazardous Materials. In the event that the Prime Contractor, any Subcontractor or anyone employed directly or indirectly by them shall use, at the Site, or incorporate into the Work, any material or substance deemed to be hazardous or toxic under any law, rule, ordinance, regulation or interpretation thereof (collectively "Hazardous Materials"), the Prime Contractor shall comply with all laws, rules, ordinances or regulations applicable thereto and shall exercise all necessary safety precautions relating to the use, storage or disposal thereof.

4.9.7.2. Prohibition on Use of Asbestos Construction Building Materials ("ACBMs"). Notwithstanding any provision of the Drawings or the Specifications to the contrary, it is the intent of the District that

ACBMs not be used or incorporated into any portion of the Work. In the event that any portion of the Work depicted in the Drawings or the Specifications shall require materials or products which the Prime Contractor knows, or should have known with reasonably diligent investigation, to contain ACBM's, Prime Contractor shall promptly notify the Engineer and the District's Inspector of the same so that an appropriate alternative can be made in a timely manner so as not to delay the progress of the Work. Prime Contractor warrants to the District that there are no materials or products used or incorporated into the Work which contain ACBM's. Whether before or after completion of the Work, if it is discovered that any product or material forming a part of the Work or incorporated into the Work contains ACBM's, the Prime Contractor shall at its sole cost and expense remove such product or material in accordance with any laws, rules, procedures and regulations applicable to the handling, removal and disposal of ACBM's and to replace such product or material with non-ACBM products or materials and to return the affected portion(s) of the Work to the finish condition depicted in the Drawings and Specifications relating to such portion(s) of the Work. Prime Contractor's obligations under the preceding sentence shall survive the termination of the Contract, the warranty period provided under the Contract Documents, the Prime Contractor's completion of the Work or the District's acceptance of the Work. In the event that the Prime Contractor shall fail or refuse, for any reason, to commence the removal and replacement of any material or product containing ACBM's forming a part of, or incorporated into the Work, within ten (10) days of the date of the District's written notice to the Prime Contractor of the existence of ACBM materials or products in the Work, the District may thereafter proceed to cause the removal and replacement of such materials or products in any manner which the District determines to be reasonably necessary and appropriate; all costs, expenses and fees, including without limitation fees and costs of consultants and attorneys, incurred by the District in connection with such removal and replacement shall be the responsibility of the Prime Contractor and the Prime Contractor's Performance Bond Surety.

4.9.7.3. Disposal of Hazardous Materials. Prime Contractor shall be solely and exclusively responsible for the disposal of any Hazardous Materials on or about the Prime Contractor's obligations hereunder shall include without limitation, the transportation and disposal of any Hazardous Materials in strict conformity with any and all applicable laws, regulations, orders, procedures or ordinances.

4.10. Maintenance of Documents.

4.10.1. Documents at Site. The Prime Contractor shall maintain at the Site: (i) one record copy of the Drawings, Specifications and all addenda thereto; (ii) Change Orders approved by the District and all other modifications to the Contract Documents; (iii) Submittals reviewed by the Engineer; (iv) Record Drawings; (v) Material Safety Data Sheets ("MSDS") accompanying any materials, equipment or products delivered or stored at the Site or incorporated into the Work; and (vi) all building and other codes or regulations applicable to the Work, including without limitation, Title 24, Part 2 of the California Code of Regulations. During performance of the Work, all documents maintained by Prime Contractor at the Site shall be available to the District, the Project Manager, the Engineer, the District's Inspector and DSA for review, inspection or reproduction. Upon completion of the Work, all documents maintained at the Site by the Prime Contractor pursuant to the foregoing shall be assembled and transmitted to the Engineer for delivery to the District.

4.10.2. Maintenance of Record Drawings. During its performance of the Work, the Prime Contractor shall maintain Record Drawings, as described in Article 1.18 hereof, consisting of a set of the Drawings which are marked to indicate all field changes made to adapt the Work depicted in the Drawings to field conditions, changes resulting from Change Orders and all concealed or buried installations, including without limitation, piping, conduit and utility services. All buried or concealed items of Work shall be completely and accurately marked and located on the Record Drawings. The Record Drawings shall be clean and all changes, corrections and dimensions shall be marked in a neat and legible manner in a contrasting color. Record Drawings relating to the Structural, Mechanical, Electrical and Plumbing portions of the Work shall indicate without limitation, circuiting, wiring sizes, equipment/member sizing and shall depict the entirety of the as built conditions of such portions of the Work. The Record Drawings shall be continuously maintained by the Prime Contractor during the performance of the Work. At any time during the Prime Contractor's performance of the Work, upon the request of the District, the District's Inspector or the Engineer, the Prime Contractor shall make the Record Drawings maintained here under available for the District's review and inspection. The District's review and inspection of the Record Drawings during the Prime Contractor's performance of the Work shall be only for the purpose of generally verifying that Prime Contractor is continuously maintaining the Record Drawings in a complete and accurate manner; any such inspection or review shall not be deemed to be the District's approval or verification of the completeness or accuracy thereof. The failure or refusal of the Prime Contractor to continuously maintain complete and accurate Record Drawings or to make available the Record Drawings for inspection and review by the District may be deemed by the District to be Prime Contractor's default of a material obligation hereunder. Without waiving, restricting or limiting any other right or remedy of the District for the Prime Contractor's failure or refusal to continuously maintain the Record

Drawings, the District may, upon reasonably determining that the Prime Contractor has not, or is not, continuously maintaining the Record Drawings in a complete and accurate manner, take appropriate action to cause the continuous maintenance of complete and accurate Record Drawings, in which event all fees and costs incurred or associated with such action shall be charged to the Prime Contractor and the District may deduct the amount of such fees and costs from any portion of the Contract Price then or thereafter due the Prime Contractor. In accordance with Article 8.4.2 of these General Conditions, prior to receipt of the Final Payment, Prime Contractor shall deliver the Record Drawings to the Project Manager.

4.11. Use of Site. The Prime Contractor shall confine operations at the Site to areas permitted by law, ordinances or permits, subject to any restrictions or limitations set forth in the Contract Documents. The Prime Contractor shall not unreasonably encumber the Site or adjoining areas with materials or equipment. The Prime Contractor shall be solely responsible for providing security at the Site with all such costs included in the Contract Price. The District shall at all times have access to the Site.

4.12. Clean-Up. The Prime Contractor shall at all times keep the Site and all adjoining areas free from the accumulation of any waste material or rubbish caused or generated by performance of the Work. Without limiting the generality of the foregoing, Prime Contractor shall maintain the Site in a "rake-clean" standard on a daily basis. In the event that the Work of the Contract Documents includes painting and/or the installation of floor covering, prior to commencement of any painting operations or the installation of any flooring covering, the area and adjoining areas of the Site where paint is to be applied or floor covering is to be installed shall be in a "broom-clean" condition. Prior to completion of the Work, Prime Contractor shall remove from the Site all rubbish, waste material, excess excavated material, tools, Construction Equipment, machinery, surplus material and any other items which are not the property of the District under the Contract Documents. Upon completion of the Work, the Site and all adjoining areas shall be left in a neat and broom clean condition satisfactory to District. The District's Inspector or Project Manager shall be authorized to direct the Prime Contractor's clean-up obligations hereunder. If the Prime Contractor fails to clean up as provided for in the Contract Documents, the District may do so, and all costs incurred in connection therewith shall be charged to the Prime Contractor; the District may deduct such costs from any portion of the Contract Price then or thereafter due the Prime Contractor.

4.13. Access to the Work. The Prime Contractor shall provide the DSA, the District, the Project Manager, the District's Inspector, the Engineer and the Engineer's consultant(s) with access to the Work, whether in place, preparation and progress and wherever located.

4.14. Facilities and Information for the District's Inspector.

4.14.1. Information to District's Inspector. The Prime Contractor shall furnish the District's Inspector access to the Work for obtaining such information as may be necessary to keep the District's Inspector fully informed respecting the progress, quality and character of the Work and materials, equipment or other items

incorporated therein. The District's Inspector shall be authorized to exercise the District's rights under Article 2.2 of the General Conditions with respect to stoppage of the Work.

4.14.2. Facilities for District's Inspector. The Project Manager shall provide, at no additional cost or expense to the District, for use by the District, the Project Manager, at the Site, a temporary trailer meeting or exceeding the requirements set forth in the Specifications, along with the items of furniture, furnishings and office equipment identified in the Specifications. The Project Manager shall provide and pay for all costs, including without limitation, utility and telephone services associated with the use of such temporary trailer, until removal of the same is authorized by the District. The costs for providing of all such items pursuant to the foregoing shall be included within the Contract Price.

4.15. Patents and Royalties. The Prime Contractor and the Surety shall defend, indemnify and hold harmless the District and its agents, employees and officers from any claim, demand or legal proceeding arising out of or pertaining, in any manner, to anyactua1 or claimed infringement of patent rights in connection with performance of the Work under the Contract Documents.

4.16. Cutting and Patching. The Prime Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make the component parts thereof fit together properly. The Prime Contractor shall not damage or endanger any portion of the Work, or the fully or partially completed construction of the District or separate contractors by cutting, patching, excavation or other alteration. The Prime Contractor shall not cut, patch or otherwise alter the construction by the District or separate contractor without the prior written consent of the District or separate contractor thereto, which consent shall not be unreasonably withheld. The Prime Contractor shall not unreasonably withhold consent to the request of the District or separate contractor to cut, patch or otherwise alter the Work.

4.17. Encountering of Hazardous Materials. In the event the Prime Contractor encounters Hazardous Materials at the Site which have not been rendered harmless or for which there is no provision in the Contract Documents for containment, removal, abatement or handling of such Hazardous Materials, the Prime Contractor shall immediately stop the Work in the affected area, but shall diligently proceed with the Work in all other unaffected areas. Upon encountering such Hazardous Materials, the Prime Contractor shall immediately notify the District's Inspector and the Engineer, in writing, of such condition. The Prime Contractor shall proceed with the Work in such affected area only after such Hazardous Materials have been rendered harmless, contained, removed or abated. In the event such Hazardous Materials are encountered, the Prime Contractor shall be entitled to an adjustment of the Contract Time to the extent that the Work is stopped and Substantial Completion of the Work is affected thereby. In no event shall there be an adjustment to the Contract Price solely on account of the Prime Contractor encountering such Hazardous Materials.

4.18. Wage Rates; Employment of Labor.

4.18.1. Determination of Prevailing Rates. Pursuant to the provisions of Division 2, Part 7, Chapter I, Article 2 of the California Labor Code at §1770 et seq., the District has obtained from the Director of the Department of Industrial Relations the general prevailing rate of per diem wages and the prevailing rate for holiday and overtime work in the locality in which the Work is to be performed for each craft, classification or type of worker needed to execute the Contract. Holidays shall be as defined in the collective bargaining agreement applicable to each particular craft, classification or type of worker employed under the Contract. Per diem wages shall be deemed to include employer payments for health and welfare, pensions, vacation, travel time and subsistence pay as provided in California Labor Code §1773.8, apprenticeship or other training programs authorized by California Labor Code §3093, and similar purposes when the term "per diem wages" is used herein. Holiday and overtime work, when permitted by law, shall be paid for at the rate of at least one and one-half (1 1/2) times the above specified rate of per diem wages, unless otherwise specified. The Prime Contractor shall post, at appropriate and conspicuous locations on the Site, a schedule showing all determined general prevailing wage rates.

4.18.2. Payment of Prevailing Rates. Each worker employed by the Prime Contractor, or any Subcontractor, of any tier, engaged in the Work, shall be paid not less than the general prevailing wage rate, regardless of any contractual relationship which may be alleged to exist between the Prime Contractor or any Subcontractor, of any tier, and such worker.

4.18.3. Prevailing Rate Penalty. The Prime Contractor shall, as a penalty, forfeit Fifty Dollars ($50) to the District for each calendar day or portion thereof, for each worker paid less than the prevailing rates as determined by the Director of the Department of Industrial Relations for such work or craft in which such worker is employed for the Work by the Prime Contractor or by any Subcontractor, of any tier, in connection with the Work. Pursuant to California Labor Code §1775, the difference between such prevailing wage rates and the amount paid to each worker for each calendar day, or portion thereof, for which each worker was paid less than the prevailing wage rate, shall be paid to each worker by the Prime Contractor.

4.18.4. Payroll Records. Pursuant to California Labor Code §1776, each Prime Contractor and each Subcontractor, of any tier, shall keep an accurate payroll record, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each person employed for the Work. The payroll records shall be certified and available for inspection at all reasonable hours at the principal office of the Prime Contractor on the following basis: (i) a certified copy of an employee's payroll record shall be made available for inspection or furnished to such employee or his/her authorized representative on request; (ii)

a certified copy of all payroll records shall be made available for inspection or furnished upon request to the District, the Division of Labor Standards Enforcement and the Division of Apprenticeship Standards of the Department of Industrial Relations; (iii) a certified copy of payroll records shall be made available upon request to the public for inspection or copies thereof made; provided, however, that a request by the public shall be made through either the District, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. If the requested payroll records have not been provided, the requesting party shall, prior to being provided the records, reimburse the cost of preparation by the Contractor, Subcontractors and the entity through which the request was made; the public shall not be given access to such records at the principal office of the Prime Contractor; (iv) the Prime Contractor shall file a certified copy of the payroll records with the entity that requested such records within ten (10) days after receipt of a written request; (v) any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the District, the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address and social security number. The name and address of the Prime Contractor or any Subcontractor, of any tier, performing a part of the Work shall not be marked or obliterated. The Prime Contractor shall inform the District of the location of payroll records, including the street address, city and county and shall, within five (5) working days, provide a notice of a change or location and address. In the event of noncompliance with the requirements of this Article 4.18.4, the Prime Contractor shall have ten (10) days in which to comply, subsequent to receipt of written notice specifying in what respects the Prime Contractor must comply herewith. Should noncompliance still be evident after such ten (10) day period, the Prime Contractor shall, as a penalty to the District, forfeit Twenty-Five Dollars ($25) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, such penalties shall be withheld from any portion of the Contract Price then or thereafter due the Prime Contractor. The Prime Contractor is solely responsible for compliance with the foregoing provisions.

4.18.5. Hours of Work.

4.18.5.1. Limits on Hours of Work. Pursuant to California Labor Code §1810, eight (8) hours of labor shall constitute a legal day's work. Pursuant to California Labor Code §1811, the time of service of any worker employed at any time by the Prime Contractor or by a Subcontractor, of any tier, upon the Work or upon any part of the Work, is limited and restricted to eight (8) hours during anyone calendar day and forty (40) hours during anyone calendar week, except as hereafter provided. Notwithstanding the foregoing provisions, Work performed by employees of Prime Contractor or any Subcontractor,

of any tier, in excess of eight (8) hours per day and forty (40) hours during anyone week, shall be permitted upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half (1 1/2) times the basic rate of pay.

4.18.5.2. Penalty for Excess Hours. The Prime Contractor shall pay to the District Twenty-five Dollars ($25) for each worker employed on the Work by the Prime Contractor or any Subcontractor, of any tier, for each calendar day during which such worker is required or permitted to work more than eight (8) hours in any calendar day and forty (40) hours in anyone calendar week, in violation of the provisions of the California Labor Code, unless compensation to the worker so employed by the Prime Contractor is not less than one and one-half (1 1/2) times the basic rate of pay for all hours worked in excess of eight (8) hours per day.

4.18.5.3. Prime Contractor Responsibility. Any Work performed by workers necessary to be performed after regular working hours or on Sundays or other holidays shall be performed without adjustment to the Contract Price or any other additional expense to the District.

4.18.6. Apprentices.

4.18.6.1. Employment of Apprentices. All apprentices employed by the Prime Contractor to perform any of the Work shall be paid the standard wage paid to apprentices under the regulations of the craft or trade for which such apprentice is employed, and such individual shall be employed only for the work of the craft or trade to which such individual is registered. Only apprentices, as defined in California Labor Code §3077 who are in training under apprenticeship standards and written apprenticeship agreements under California Labor Code §§3070 et seq. are eligible to be employed for the Work. The employment and training of each apprentice shall be in accordance with the provisions of the apprenticeship standards and apprentice agreements under which such apprentice is training.

4.18.6.2. Apprenticeship Certificate. When the Prime Contractor or any Subcontractor, of any tier, in performing any of the Work employs workers in any Apprenticeable Craft or Trade, the Prime Contractor and such Subcontractor shall apply to the Joint Apprenticeship Committee administering the apprenticeship standards of the craft or trade in the area of the site of the Work for a certificate approving the Prime Contractor or such Subcontractor under the apprenticeship standards for the employment and training of apprentices in the area or industry affected, provided, however, that the approval as

established by the Joint Apprenticeship Committee or Committees shall be subject to the approval of the Administrator of Apprenticeship. The Joint Apprenticeship Committee or Committees, subsequent to approving the Prime Contractor or Subcontractor, shall arrange for the dispatch of apprentices to the Prime Contractor or such Subcontractor in order to comply with California Labor Code § 1777 .5. The Prime Contractor and Subcontractors shall submit contract award information to the applicable Joint Apprenticeship Committee which shall include an estimate of journeyman hours to be performed under the Contract, the number of apprentices to be employed, and the approximate dates the apprentices will be employed. There shall be an affirmative duty upon the Joint Apprenticeship Committee or Committees, administering the apprenticeship standards of the crafts or trades in the area of the site of the Work, to ensure equal employment and affirmative action and apprenticeship for women and minorities. Prime Contractors or Subcontractors shall not be required to submit individual applications for approval to local Joint Apprenticeship Committees provided they are already covered by the local apprenticeship standards.

4.18.6.3. Ratio of Apprentices to Journeymen. The ratio of Work performed by apprentices to journeymen, who shall be employed in the Work, may be the ratio stipulated in the apprenticeship standards under which the Joint Apprenticeship Committee operates, but in no case shall the ratio be less than one hour of apprentice work for each five hours of labor performed by a journeyman, except as otherwise provided in California Labor Code § 1777.5. The minimum ratio for the land surveyor classification shall not be less than one apprentice for each five journeymen. Any ratio shall apply during any day or portion of a day when any journeyman or the higher standard stipulated by the Joint Apprenticeship Committee, is employed at the site of the Work and shall be computed on the basis of the hours worked during the day by journeymen so employed, except for the land surveyor classification. The Prime Contractor shall employ apprentices for the number of hours computed as above before the completion of the Work. The Prime Contractor shall, however, endeavor, to the greatest extent possible, to employ apprentices during the same time period that the journeymen in the same craft or trade are employed at the site of the Work. Where an hourly apprenticeship ratio is not feasible for a particular craft or trade, the Division of Apprenticeship Standards, upon application of a Joint Apprenticeship Committee, may order a minimum ratio of not less than one apprentice for each five journeymen in a craft or trade classification. The Prime Contractor or any Subcontractor covered by this Article and California Labor Code § 1777.5, upon the issuance of the approval certificate, or if it has been previously approved in such

craft or trade, shall employ the number of apprentices or the ratio of apprentices to journeymen stipulated in the apprenticeship standards. Upon proper showing by the Prime Contractor that it employs apprentices in such craft or trade in the State of California on all of its contracts on an annual average of not less than one apprentice to each five journeymen, the Division of Apprenticeship Standards may grant a certificate exempting the Prime Contractor from the 1-to-5 ratio as set forth in this Article and California Labor Code §1777.5. This Article shall not apply to contracts of Prime Contractors, or to contracts of specialty contractors not bidding for work through a Prime Contractor, involving less than Thirty Thousand Dollars ($30,000) or twenty (20) working days. The term "Apprenticeable Craft or Trade," as used herein shall mean a craft or trade determined as an Apprenticeable occupation in accordance with rules and regulations prescribed by the Apprenticeship Council.

4.18.6.4. Exemption from Ratios. The Joint Apprenticeship Committee shall have the discretion to grant a certificate, which shall be subject to the approval of the Administrator of Apprenticeship, exempting the Prime Contractor from the 1-to-5 ratio set forth in this Article when it finds that anyone of the following conditions are met: (i) unemployment for the previous three-month period in such area exceeds an average of fifteen percent (15%) or; (ii) the number of apprentices in training in such area exceeds a ratio of 1-to-5 in relation to journeymen, or; (iii) the Apprenticeable Craft or Trade is replacing at least one-thirtieth (1/30) of its journeymen annually through apprenticeship training, either on a statewide basis or on a local basis, or; (iv) if assignment of an apprentice to any Work performed under the Contract Documents would create a condition which would jeopardize such apprentice's life or the life, safety or property of fellow employees or the public at large, or if the specific task to which the apprentice is to be assigned is of such a nature that training cannot be provided by a journeyman. When such exemptions from the 1-to-5 ratio between apprentices and journeymen are granted to an organization which represents Prime Contractors in a specific trade on a local or statewide basis, the member Prime Contractors will not be required to submit individual applications for approval to local Joint Apprenticeship Committees, provided they are already covered by the local apprenticeship standards.

4.18.6.5. Contributions to Trust Funds. The Prime Contractor or any Subcontractor, of any tier, who, performs any of the Work by employment of journeymen or apprentices in any Apprenticeable Craft or Trade and who is not contributing to a fund or funds to administer and conduct the apprenticeship program in any such craft or trade in the area of the site of the Work, to which fund or funds

other Prime Contractors in the area of the site of the Work are contributing, shall contribute to the fund or funds in each craft or trade in which it employs journeymen or apprentices in the same amount or upon the same basis and in the same manner as the other Prime Contractors do, but where the trust fund administrators are unable to accept such funds, contractors not signatory to the trust agreement shall pay a like amount to the California Apprenticeship Council. The Division of Labor Standards Enforcement is authorized to enforce the payment of such contributions to such fund(s) as set forth in California Labor Code §227. Such contributions shall not result in an increase in the Contract Price.

4.18.6.6. Prime Contractor's Compliance. The responsibility of compliance with this Article for all Apprenticeable Trades or Crafts is solely and exclusively that of the Prime Contractor. All decisions of the Joint Apprenticeship Committee(s) under this Article are subject to the provisions of California Labor Code §3081. In the event the Prime Contractor willfully fails to comply with the provisions of this Article and California Labor Code §1777.5, pursuant to California Labor Code §1777.7, the Prime Contractor shall: (i) be denied the right to bid on any public works contract for a period of one (1) year from the date the determination of non-compliance is made by the Administrator of Apprenticeship; and (ii) forfeit, as a civil penalty, Fifty Dollars ($50) for each calendar day of noncompliance. Notwithstanding the provisions of California Labor Code §1727, upon receipt of such determination, the District shall withhold such amount from the Contract Price then due or to become due. Any such determination shall be issued after a full investigation, a fair and impartial hearing, and reasonable notice thereof in accordance with reasonable rules and procedures prescribed by the California Apprenticeship Council. Any funds withheld by the District pursuant to this Article shall be deposited in the General Fund or other similar fund of the District. The interpretation and enforcement of California Labor Code §1777.5 and §1777.7 shall be in accordance with the rules and procedures of the California Apprenticeship Council.

4.18.7. Employment of Independent Prime Contractors. Pursuant to California Labor Code §1021.5, Prime Contractor shall not willingly and knowingly enter into any agreement with any person, as an independent contractor, to provide any services in connection with the Work where the services provided or to be provided requires that such person hold a valid contractor's license issued pursuant to California Business and Professions Code §7000 et seq. and such person does not meet the burden of proof of his/her independent contractor status pursuant to California Labor Code §2750.5. In the event that Prime Contractor shall employ any person in violation of the foregoing, Prime Contractor shall be subject to the civil penalties under California Labor Code

§1021.5 and any other penalty provided by law. In addition to the penalties provided under California Labor Code §1021.5, Prime Contractor's violation of this Article 4.18.7 or the provisions of California Labor Code § 1021.5 shall be deemed an event of Prime Contractor's default under Article 15.1 of these General Conditions. The Prime Contractor shall require any Subcontractor or Sub-Subcontractor performing or providing any portion of the Work to adhere to and comply with the provisions of this Article 4.18.7.

4.19. Assignment of Antitrust Claims. Pursuant to California Government Code §4551, the Prime Contractor and its Subcontractor(s), of any tier, hereby offers and agrees to assign to the District all rights, title and interest in and to all causes of action they may have under Section 4 of the Clayton Act, (15 U.S.C. §15) or under the Cartwright Act (California Business and Professions Code §16700 et seq.), arising from purchases of goods, services or materials hereunder or any Subcontract. This assignment shall be made and become effective at the time the District tenders Final Payment to the Prime Contractor, without further acknowledgment by the parties. If the District receives, either through judgment or settlement, a monetary recovery in connection with a cause of action assigned under California Government Code §4550 et seq., the assignor thereof shall be entitled to receive reimbursement for actual legal costs incurred and may, upon demand, recover from the District any portion of the recovery, including treble damages, attributable to overcharges that were paid by the assignor but were not paid by the District as part of the Contract Price, less the expenses incurred by the District in obtaining that portion of the recovery. Upon demand in writing by the assignor, the District shall, within one (1) year from such demand, reassign the cause of action assigned pursuant to this Article if the assignor has been or may have been injured by the violation of law for which the cause of action arose: (i) the District has not been injured thereby; or (ii) the District declines to file a court action for the cause of action.

4.20. Daily Progress Reports. During the progress of the Work, the Contractor's superintendent or project manager shall prepare daily progress reports; not later than 12:00 P.M. of each Tuesday during the Work, the Contractor shall submit the prior daily progress reports for the prior week to the Project Manager. The contents of each daily progress report shall include: (i) workers of the Contractor and Subcontractors at the Site; (ii) weather conditions; (iii) portions of the Work completed or in progress; (iv) deliveries of major items of materials or equipment to the Site; (v) safety issues; and (vi) actual or potential schedule/progress impacts. The preparation and submittal of daily progress reports in strict conformity to the foregoing are material obligations of the Contractor under the Contract Documents. In addition to the rights of the District to withhold Progress Payments or the Final Payment as set forth elsewhere in the Contract Documents, the District may withhold Progress Payments and/or Final Payment until the Contractor has completed all daily progress reports and has submitted such daily progress reports to the Project Manager.

ARTICLE 5: SUBCONTRACTORS

5.1. Subcontracts. Any portion of the Work performed for the Prime Contractor by a Subcontractor shall be pursuant to a written agreement between the Prime Contractor and such Subcontractor which specifically incorporates by reference the Contract Documents and which specifically binds the Subcontractor to the applicable terms and conditions of the Contract

Documents, including without limitation, the policies of insurance required under Article 6 of these General Conditions and obligates the Subcontractor to assume toward the Prime Contractor all the obligations and responsibilities of the Prime Contractor which by the Contract Documents the Prime Contractor assumes toward the District and the Engineer. The foregoing notwithstanding, no contractual relationship shall exist, or be deemed to exist, between any Subcontractor and the District, unless the Contract is terminated and District, in writing, elects to assume the Subcontract. Each Subcontract for a portion of the Work shall provide that such Subcontract may be assigned to the District if the Contract is terminated by the District pursuant to Article 15 hereof, subject to the prior rights, if any, of the Surety obligated under a bond relating to the Contract. The Prime Contractor shall provide to the District copies of all executed Subcontracts and Purchase Orders to which Prime Contractor is a party within thirty (30) days after Prime Contractor's execution of the Agreement. During performance of the Work, the Prime Contractor shall, from time to time, as and when requested by the District, the Engineer or the Project Manager provide the District with copies of any and all Subcontracts or Purchase Orders relating to the Work and all modifications thereto. The Prime Contractor's failure or refusal, for any reason, to provide copies of such Subcontracts or Purchase Orders in accordance with the two preceding sentences shall be deemed Prime Contractor's default in the performance of a material term of the Contract Documents.

5.2. Substitution of Listed Subcontractor.

5.2.1. Substitution Process. Any request of the Prime Contractor to substitute a listed Subcontractor will be considered only if such request is in strict conformity with this Article 5.2 and California Public Contract Code §4107. All costs incurred by the District, including without limitation, costs of the District's Inspector, the Engineer, the Project Manager or attorney's fees in the review and evaluation of a request to substitute a listed Subcontractor shall be borne by the Prime Contractor; such costs may be deducted by the District from the Contract Price then or thereafter due the Prime Contractor.

5.2.2. Responsibilities of Prime Contractor upon Substitution of Subcontractor. The District's consent to Prime Contractor's substitution of a listed Subcontractor shall not relieve Prime Contractor from its obligation to complete the Work within the Contract Time and for the Contract Price. The substitution of a listed Subcontractor shall not, under any circumstance, result in, or give rise to any to any increase of the Contract Price or the Contract Time on account of such substitution. In the event of the District's consent to the substitution of a listed Subcontractor, the Engineer shall determine the extent to which, if any, revised or additional Submittals will be required of the newly substituted Subcontractor. In the event that the Engineer determines that revised or additional Submittals are required of the newly substituted Subcontractor, the Engineer shall promptly notify the Prime Contractor, in writing, of such requirement. In such event, revised or additional Submittals shall be submitted to Engineer not later than thirty (30) days following the date of the Engineer's written notice to the Prime Contractor pursuant to the foregoing sentence; provided that if in the reasonable and good faith judgment of the Engineer, the progress of the Work or completion of the Work requires submission of additional or revised Submittals by the newly

substituted Subcontractor in less than thirty (30) days, the Engineer shall so state in its written notice to the Prime Contractor. In the event that the revised or additional Submittals are not submitted by Prime Contractor within thirty (30) days, or such earlier time as determined by the Engineer pursuant to the preceding sentence, following the Engineer's written notice of the requirement for revised or additional Submittals, Prime Contractor shall be subject to the per diem assessments for late Submittals as set forth in Article 4.7.2.1 of these General Conditions. Any revised or additional Submittals required pursuant to this Article 5.2.2 shall conform to the requirements of Article 4.7 of these General Conditions. Prime Contractor shall reimburse the District for all fees and costs, including without limitation fees of the Engineer or any design consultant to the Engineer or the District and DSA fees, incurred or associated with the processing, review and evaluation of any revised or additional Submittals required pursuant to this Article 5.2.2; the District may deduct such fees and costs from any portion of the Contract Price then or thereafter due the Prime Contractor. In the event that additional or revised Submittals are required pursuant to this Article 5.2.2, such requirement shall not result in an increase to the Contract Time or the Contract Price.

5.3. Subcontractor's Work. Whenever the Work of a Subcontractor is dependent upon the work of the Prime Contractor or another Subcontractor, the Prime Contractor shall require the Subcontractor to: (a) coordinate its Work with the dependent Work; (b) provide necessary dependent data and requirements; (c) supply and/or install items to be built into the dependent Work of others; (d) make appropriate provisions for dependent Work of others; (e) carefully examine and understand the portions of the Contract Documents (including Drawings, Specifications and Field Clarifications) and Submittals relating to the dependent Work is in proper condition for the Subcontractor's Work. If the dependent Work is not in a proper condition, the Subcontractor shall notify the Prime Contractor in writing and not proceed with the Subcontractor's Work until the dependent Work has been corrected or replaced and is in a proper condition for the Subcontractor's Work.

ARTICLE 6: INSURANCE; INDEMNITY; BONDS

6.1. Workers' Compensation Insurance; Employer's Liability Insurance. The Prime Contractor shall purchase and maintain Workers' Compensation Insurance as will protect the Prime Contractor from claims under workers' or workmen's compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed, whether such operations be by the Prime Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. The Prime Contractor shall purchase and maintain Employer's Liability Insurance covering bodily injury (including death) by accident or disease to any employee, which arises out of the employee's employment by the Prime Contractor. The Employer's Liability Insurance required of the Prime Contractor hereunder may be obtained by the Prime Contractor as a separate policy of insurance or as an additional coverage under the Workers' Compensation Insurance required to be obtained and maintained by the Prime Contractor hereunder. The limits of liability for the Employer's Liability Insurance required hereunder shall be as set forth in the Bid Documents or Special Conditions.

6.2. Comprehensive General Liability and Property Insurance. The Prime Contractor shall purchase and maintain Commercial General Liability and Property Insurance as will protect the Prime Contractor from the types of claims set forth below which may arise out of or result from Prime Contractor's operations under the Contract Documents and for which the Prime Contractor may be legally responsible: (i) claims for damages because of bodily injury, occupational sickness or disease or death of the Prime Contractor's employees; (ii) claims for damages because of bodily injury, sickness or disease or death of any person other than the Prime Contractor's employees; (iii) claims for damages insured by usual personal injury liability coverage which are sustained (a) by a person as a result of an offense directly or indirectly related to employment of such person by the Prime Contractor, or (b) by another person; (iv) claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting there from; (v) claims for damages because of bodily injury, death of a person or property damages arising out of ownership, maintenance or use of a motor vehicle; and (vi) contractual liability insurance applicable to the Prime Contractor's obligations under the Contract Documents.

6.3. Builder's Risk "All-Risk" Insurance. The Prime Contractor, during the progress of the Work and until Final Acceptance of the Work by the District upon completion of the entire Contract, shall maintain Builder's Risk "All-Risk" Completed Value Insurance Coverage on all insurable Work included under the Contract Documents which coverage is to provide extended coverage and insurance against vandalism and malicious mischief, perils of fire, sprinkler leakage, civil authority, sonic boom, collapse and flood upon the entire Work which is the subject of the Contract Documents, and including completed Work and Work in progress to the full insurable value thereof. Prime Contractor's Builders Risk Insurance shall include coverage and insurance against the perils of earthquake if so, indicated in the Bid Documents or Special Conditions. Such insurance shall include the District as an additional named insured and any other person with an insurable interest designated by the District as an additional named insured. The Prime Contractor shall submit to the District for its approval all items deemed to be uninsurable. The risk of damage to the Work due to the perils covered by the Builder's Risk "All Risk" Insurance, as well as any other hazard which might result in damage to the Work, is that of the Prime Contractor and the Surety, and no claims for such loss or damage shall be recognized by the District, nor will such loss or damage excuse the complete and satisfactory performance of the Contract by the Prime Contractor.

6.4. Coverage Amounts. The insurance required of the Prime Contractor hereunder shall be written for not less than any limits of liability specified in the Contract Documents, or required by law, whichever is greater. In the event of any loss or damage covered by a policy of insurance required to be obtained and maintained by the Prime Contractor hereunder, the Prime Contractor shall be solely and exclusively responsible for the payment of the deductible, if any, under such policy of insurance, without adjustment to the Contract Price on account thereof.

6.5. Evidence of Insurance; Subcontractor's Insurance.

6.5.1. Certificates of Insurance. Prior to commencement of the Work, Prime Contractor shall deliver to the District Certificates of Insurance evidencing the insurance coverage required by the Contract Documents. Failure or refusal of the Prime

Contractor to so deliver Certificates of Insurance may be deemed by the District to be a default of a material obligation of the Prime Contractor under the Contract Documents, and thereupon the District may proceed to exercise any right or remedy provided for under the Contract Documents or at law. The Certificates of Insurance and the insurance policies required by the Contract Documents shall contain a provision that coverages afforded under such policies will not be canceled or allowed to expire until at least thirty (30) days prior written notice has been given to the District. The insurance policies required of Prime Contractor hereunder shall also name the District as an additional insured as its interests may appear. Should any policy of insurance be canceled before Final Acceptance of the Work by the District and the Prime Contractor fails to immediately procure replacement insurance as required, the District reserves the right to procure such insurance and to deduct the premium cost thereof and other costs incurred by the District in connection therewith from any sum then or thereafter due the Prime Contractor under the Contract Documents. The Prime Contractor shall, from time to time, furnish the District, when requested, with satisfactory proof of coverage of each type of insurance required by the Contract Documents; failure of the Prime Contractor to comply with the District's request may be deemed by the District to be a default of a material obligation of the Prime Contractor under the Contract Documents.

6.5.2. Subcontractors' Insurance. Prime Contractor shall require that every Subcontractor, of any tier, performing or providing any portion of the Work obtain and maintain the policies of insurance set forth in Articles 6.1 and 6.2 of these General Conditions; the coverage and limits of liability of such policies of insurance to be obtained and maintained by Subcontractors shall be as set forth in the Bid Documents or Special Conditions. The policies of insurance to be obtained and maintained by Subcontractors hereunder are in addition to, and not in lieu of, Prime Contractor obtaining and maintaining such policies of insurance. Each of the policies of insurance obtained and maintained by a Subcontractor hereunder shall conform to the requirements of this Article 6. Upon request of the District, Prime Contractor shall promptly deliver to the District Certificates of Insurance evidencing that the Subcontractors have obtained and maintained policies of insurance in conformity with the requirements of this Article 6. Failure or refusal of the Prime Contractor to provide the District with Subcontractors' Certificates of Insurance evidencing the insurance coverage required hereunder shall be deemed a material default of Prime Contractor hereunder.

6.6. Maintenance of Insurance. Any insurance bearing on the adequacy of performance of Work shall be maintained after the District's Final Acceptance of all of the Work for the full one (1) year correction of Work period and any longer specific guarantee or warranty periods set forth in the Contract Documents. Should such insurance be canceled before the end of any such periods and the Prime Contractor fails to immediately procure replacement insurance as specified, the District reserves the right to procure such insurance and to charge the cost thereof to the Prime Contractor. Nothing contained in these insurance requirements is to be construed as limiting the extent of the Prime Contractor's responsibility for payment of damages resulting from its operations or

performance of the Work under the Contract Documents, including without limitation the Prime Contractor's obligation to pay Liquidated Damages. In no instance will the District's exercise of its option to occupy and use completed portions of the Work relieve the Prime Contractor of its obligation to maintain insurance required under this Article until the date of Final Acceptance of the Work by the District, or such time thereafter as required by the Contract Documents. The insurer providing any insurance coverage required hereunder shall be to the reasonable satisfaction of the District.

6.7. Prime Contractor's Insurance Primary. All insurance and the coverage there under required to be obtained and maintained by Prime Contractor hereunder, if overlapping with any policy of insurance maintained by the District, shall be deemed to be primary and noncontributing with any policy maintained by the District and any policy or coverage there under maintained by District shall be deemed excess insurance. To the extent that the District maintains a policy of insurance covering property damage arising out of the perils of fire or other casualty covered by the Prime Contractor's Builder's Risk Insurance or the Comprehensive General Liability Insurance of the Prime Contractor or any Subcontractor, the District, Prime Contractor and all Subcontractors waive rights of subrogation against the others. The costs for obtaining and maintaining the insurance coverage required herein shall be included in the Contract Price.

6.8. Indemnity. Unless arising solely out of the District's active negligence, gross negligence or willful misconduct, the Prime Contractor shall indemnify, defend and hold harmless the Indemnified Parties who are: (i) the District and its Board of Trustees, Trustees officers, employees, agents and representatives (including without limitation, the District's Inspector); (ii) the Engineer and it's consultants for the Work and their respective agents and employees; and (iii) the Construction Manager and its agents and employees from and against any and all claims, demands or liability whether for damages, losses or other relief, including, without limitations attorney's fees and costs incurred or arising there from. The foregoing shall include without limitation: (i) injuries to or death of persons; (ii) damage to property; (iii) theft or loss of property, resulting from, in whole or part, any acts, omissions or other conduct of the Prime Contractor, any of Prime Contractor's Subcontractors, of any tier, or any other person or entity employed directly or indirectly by Prime Contractor in connection with the Work and their respective agents, officers or employees. (iv) Stop Notice claims asserted by any person or entity in connection with the Work of each Prime Contractor; and (v) other losses, liabilities, damages or costs resulting from, in whole or part, any acts, omissions or other conduct of the Prime Contractor, any of such Prime Contractor's Subcontractors, of any tier, or any other person or entity employed directly or indirectly by such Prime Contractor in connection with the Work and their respective agents, officers or employees. The obligations of the Prime Contractor, as set forth in (v) above, shall include, without limitation losses, costs, expenses, damages and other claims asserted by any other contractor to the District in connection with the Work, the Project or in connection with a work of improvement related to or affected by the Work. In the event that any action or preceding, whether judicial, administrative, arbitration or otherwise, shall be commenced on account of any claim, demand or liability subject to Prime Contractor's obligations hereunder, and such action or proceeding names the District as a party thereto, the Prime Contractor shall, at its sole cost and expense, defend the District in such action or proceeding with counsel reasonably satisfactory to District. In the event that there shall be any judgment, award, ruling, settlement or other relief; Prime Contractor shall indemnify and hold harmless the District from any and all liability or responsibility arising out of any such judgment,

award, ruling, settlement or relief. The Prime Contractor's obligations hereunder shall be binding upon Prime Contractor's Performance Bond Surety and these obligations shall survive notwithstanding Prime Contractor's completion of the Work or the termination of the Contract.

6.9. Payment Bond; Performance Bond. Prior to commencement of the Work, the Prime Contractor shall furnish a Performance Bond as security for Prime Contractor's faithful performance of the Contract and a Labor and Material Payment Bond as security for payment of persons or entities performing work, labor or furnishing materials in connection with Prime Contractor's performance of the Work under the Contract Documents. Unless otherwise stated in the Special Conditions, the amounts of the Performance Bond and the Payment Bond required hereunder shall be one hundred percent (100%) of the Contract Price. Said Labor and Material Payment Bond and Performance Bond shall be in the form and content set forth in the Contract Documents. The failure or refusal of the Prime Contractor to furnish either the Performance Bond or the Labor and Material Payment Bond in strict conformity with this Article 6.9 may be deemed by the District as a default by the Prime Contractor of a material obligation hereunder. Upon request of the Prime Contractor, the District may consider and accept, but is not obligated to do so, multiple sureties on such bonds. The Surety on any bond required under the Contract Documents shall be on the list of sureties approved by the United States Department of Treasury, as set forth in the Federal Register and/or an Admitted Surety Insurer as that term is defined in California Code of Civil Procedure §995.120.

ARTICLE 7: CONTRACT TIME

7.1. Substantial Completion of the Work within Contract Time. Unless otherwise expressly provided in the Contract Documents, the Contract Time is the period of time, including authorized adjustments thereto, allotted in the Contract Documents for Substantial Completion of the Work. The date for commencement of the Work is the date established by the Notice to Proceed issued by the District pursuant to the Agreement, which shall not be postponed by the failure to act of the Prime Contractor or of persons or entities for which the Prime Contractor is responsible. The date of Substantial Completion is the date certified by the Engineer and the District's Inspector as such in accordance with the Contract Documents. The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

7.2. Progress and Completion of the Work.

7.2.1. Time of Essence. Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Prime Contractor confirms that the Contract Time is a reasonable period for performing and achieving Substantial Completion of the Work. The Prime Contractor shall employ and supply a sufficient force of workers, material, and equipment, and shall prosecute the Work with such diligence so as to maintain progress, to prevent Work stoppage and to achieve Substantial Completion of all of the Work within the Contract Time.

7.2.2. Substantial Completion. Substantial Completion is that stage in the progress of the Work when the Work is complete in accordance with the Contract Documents so the District can occupy or use the Work for its intended purpose. Substantial Completion shall be determined by the Engineer and/or the District's Inspector upon request by the Prime Contractor in accordance with the Contract Documents. The good faith and reasonable determination of Substantial Completion by the Engineer and/or District Inspector shall be controlling and final.

7.2.3. Correction or Completion of the Work after Substantial Completion.

7.2.3.1. Items for Correction or Completion. Upon achieving Substantial Completion of the Work, the District, the District's Inspector, the Project Manager, the Engineer and the Prime Contractor shall jointly inspect the Work and prepare a comprehensive list of items of the Work to be corrected or completed by the Prime Contractor. The exclusion of, or failure to include, any item on such list shall not alter or limit the obligation of the Prime Contractor to complete or correct any portion of the Work in accordance with the Contract Documents.

7.2.3.2. Time for Completing Correction or Completion Items. In addition to setting forth items for correction or completion pursuant to Article 7.2.3.1, the District, Project Manager, Prime Contractor and Engineer shall, after the joint inspection, establish a reasonable time for Prime Contractor's completion of all items requiring correction or completion. In the event that the District, the Prime Contractor and the Engineer are unable to mutually agree upon the time for the Prime Contractor's completion of such items, the Engineer shall determine such time, and in such event, the time determined by the Engineer shall be final and binding upon the District and Prime Contractor so long as the Engineer's determination is made in good faith. The Prime Contractor shall promptly and diligently proceed to complete or correct all items noted on such list within the time established. In the event that the Prime Contractor shall fail or refuse, for any reason, to complete items requiring completion or correction within the time so established, Prime Contractor shall be subject to assessment of Liquidated Damages in accordance with Article 7.5 hereof. The foregoing notwithstanding, in the event of Prime Contractor's failure or refusal to complete all items of the Work requiring correction or completion within the time so established, the District may, in its sole and exclusive discretion and without further notice to Prime Contractor, elect to cease the completion of such items of the Work requiring correction or completion, provided, however, that such election by the District shall be in addition to, and not in lieu of, any other right or remedy of the District under the Contract Documents or at law. In the event that the District shall elect to complete items of

the Work requiring correction or completion, pursuant to the foregoing, the Prime Contractor shall be responsible for all costs incurred by the District in connection therewith and the District may deduct such costs from any portion of the Contract Price then or thereafter due the Prime Contractor. In the event the costs incurred by the District to perform the items requiring correction or completion shall exceed the remaining Contract Price due to the Prime Contractor, the Prime Contractor's Performance Bond Surety shall be liable to District for any such excess costs.

7.2.4. Final Completion. Final Completion is that stage of the Work when all Work has been completed in accordance with the Contract Documents, including without limitation, the performance of all correction or completion items noted upon Substantial Completion, and the Contract has been otherwise fully performed by the Prime Contractor. Final Completion shall be determined by the Engineer and the District's Inspector upon request of the Prime Contractor. The good faith and reasonable determination of Final Completion by the District's Inspector and the Engineer shall be controlling and final.

7.2.5. Prime Contractor Responsibility for Multiple Inspections. In the event the Prime Contractor shall request determination of Substantial Completion or Final Completion by the District's Inspector and the Engineer and it is determined by the District's Inspector and the Engineer that the Work does not then justify certification of Substantial Completion or Final Completion and re-inspection is required at a subsequent time to make such determination, the Prime Contractor shall be responsible for all costs of such re-inspection, including without limitation, the fees of the Engineer and the salary of the District's Inspector. The District may deduct all such costs from the balance of the Contract Price then due or thereafter due to the Prime Contractor.

7.2.6. Final Acceptance. Final Acceptance of the Work shall occur upon approval of the Work by the District's Board of Trustees; such approval shall be submitted for adoption at the next regularly scheduled meeting of the District's Board of Trustees after the determination of Final Completion. The commencement of any warranty or guarantee period under the Contract Documents shall be deemed to be the date upon which the District's Board of Trustees approves of the Final Acceptance of the Work.

7.3. Construction Schedule.

7.3.1. Construction Schedule Terms Defined.

7.3.1.1. Bid Schedule. The Bid Schedule is the Schedule issued with the Bid Documents, which shall be used by the Prime Contractor and its Subcontractor(s) for preparation of the Prime Contractor's Bid

Proposal.

7.3.1.2. Preliminary Base Line Construction Schedule. The Preliminary Base Line Construction Schedule is the schedule created by the Prime Contractor, within seven (7) days after of the Notice to Proceed is issued by or on behalf of the District, for proposing revisions to the Bid Schedule.

7.3.1.3. Base Line Construction Schedule. The Base Line Construction Schedule is developed from the input of each Prime Contractor's Preliminary Base Line Construction Schedule. The Base Line Construction Schedule shall be used for the initial commencement of construction, scheduling, monitoring of the Project on a continual basis until Updated Construction Schedules are issued.

7.3.1.4. Updated Construction Schedule. The Updated Construction Schedules are the Construction Schedules issued after the Base Line Construction Schedule. Additionally, the Updated Construction Schedule may be used for bidding by any Contractor for work to commence on the Project subsequent to the Base Line Construction Schedule.

7.3.1.5. Recovery Schedule. A Recovery Schedule is a Construction Schedule prepared by the Contractor for a Bid Package to illustrate the manner in which such Contractor shall recover lost time due to delays with the progress of the Contractor's Work and the Contractor's ability to meet Milestones and/or Project completion dates/requirements.

7.3.1.6. Construction Schedule(s). Construction Schedules collectively refer to the Bid Schedule, Preliminary Base Line Construction Schedule, Base Line Construction Schedule, and Updated Construction Schedule.

7.3.1.7. Three Week Look Ahead Schedules. Three Week Look Ahead Schedules shall be issued on a weekly basis at the Project Team Meeting identifying Work in more detail than the activities shown in the Construction Schedules.

7.3.2. Bid Schedule. The Bid Schedule is for reference only. Any contractor awarded a contract for any portion of the Project shall comply with the Project Manager's directives regarding the scheduling, sequencing and coordination of the Work. The District expressly reserves the right to modify the Bid Schedule based upon input from the Prime Contractor or other project requirements. The Prime Contractor acknowledges and agrees that modifications to the Bid Schedule after award of the Contract shall not be a basis for adjustment of the Contract Time or

the Contract Price.

7.3.3. Preliminary Base Line Schedule. Within seven (7) days following issuance of the Notice to Proceed, the Prime Contractor shall prepare and submit to the Project Manager a Contractor's Preliminary Construction Schedule reflecting all of Contractor's proposed revisions and recommendations to the Bid Schedule or, in the alternative, Contractor shall notify the District, in writing, that Contractor has no proposed revisions or recommendations to the Bid Schedule. The Prime Contractor acknowledges and agrees that its proposed modifications to the Bid Schedule are subject to acceptance by the District in the sole and exclusive discretion of the District. The Prime Contractor may submit proposed revisions to the Bid Schedule depicting completion of the Work in a duration shorter than the Contract Time established for the Bid Package; provided that if such proposed modifications to the Bid Schedule are accepted, such acceptance shall not be a basis for adjustment to the Contract Price in the event that completion of the Work shall occur after the time depicted therein, nor shall revisions to the Bid Schedule be the basis for any extension of the Contract Time. If the Prime Contractor does not submit a Contractor's Preliminary Construction Schedule within ten (10) days following the issuance of the Notice to Proceed, Contractor shall be deemed to have waived its right to submit a Contractor Preliminary Construction Schedule.

7.3.4. Baseline Construction Schedule. Based upon the approved input from the Preliminary Baseline Schedules for the entirety of the Project, the Project Manager will develop and issue a Baseline Construction Schedule. The Baseline Construction Schedule shall control and govern over the sequencing and scheduling noted in the Bid Schedule. The Work shall conform to the Baseline Construction Schedule, including updates and/or revisions thereto. The Base Line Construction Schedule shall be reviewed and updated at Project meeting(s) held periodically during the progress of the Work. If the Work appears to be delayed such that the Work will not comply with required milestone dates, the Bid Package Substantial Completion date and/or the Project Completion date set forth in the Baseline Construction Schedule(s), the Prime Contractor whose activity is on the critical path and/or who has caused the delay(s) shall be liable and assessed Liquidated Damages in accordance with the terms and provisions of the Agreement and these General Conditions.

7.3.5. Updated Construction Schedules. In the event that the progress of the Work or the sequencing of the activities of the Work shall materially differ from that indicated in the Baseline Construction Schedule, the Project Manager may direct the Prime Contractor to propose revisions to update the approved Baseline Construction Schedule. The Prime Contractor shall prepare and submit, within two (2) days, to the Project Manager revised input, in graphic form, to the Baseline Construction Schedule. The Prime Contractor may request consent of the Project Manager to revise the approved Baseline Construction Schedule. Any such request shall be considered by the Project Manager and District only if in writing setting forth the Prime Contractor's proposed revision(s) to the Baseline

Construction Schedule and the reason(s) therefore. The Project Manager and District may consent to or deny in its reasonable discretion any such request of the Prime Contractor to revise the Baseline Construction Schedule. Also, the Project Manager may incorporate elements of the Three Week Look Ahead Schedules, as described below, into the Updated Construction Schedule. The Project Manager will incorporate accepted revisions to the Baseline Construction Schedule and issue an Updated Construction Schedule.

7.3.6. Recovery Schedules. The Prime Contractor working on critical path items or whose progress of Work is behind that indicated in the current Updated Construction Schedule shall monitor and update the most recently approved Updated Construction Schedule on a monthly basis, or more frequently as required by the conditions or progress of the Work, or as requested by the Project Manager. The Prime Contractor shall provide the Project Manager with updated Recovery Schedules indicating utilized and projected manpower, progress achieved and activities commenced or completed within the prior Updated Construction Schedule. The Prime Contractor must also provide a written and/or graphic plan to the Project Manager, within forty-eight (48) hours of request, that recovers lost time to achieve the milestone dates and sequencing of activities established in the most recent Updated Construction Schedule. The Project Manager may direct the sequence in which the various portions of Work within a Bid Package or between Bid Packages shall be performed and may adjust the Construction Schedule(s) at any time the Project Manager considers the completion date to be in jeopardy because of "activities behind schedule." Without adjustment of the Contract Time or the Contract Price, the Prime Contractor shall comply and perform in accordance with revisions to the Construction Schedule(s) issued by the Project Manager hereunder. If requested by the Project Manager, the Prime Contractor shall also submit, with its updates, a narrative statement including a description of current and anticipated problem areas of the Work, delaying factors and their impact, and an explanation of corrective action taken or proposed by the Prime Contractor. The District may, from time to time, and in the District's sole and exclusive discretion, transmit to the Contractor's Performance Bond Surety the Construction Schedule, any updates thereof and the narrative statement described hereinabove. The District's election to transmit, or not to transmit such information, to the Contractor's Performance Bond Surety shall not limit the Contractor's obligations under the Contract Documents.

7.3.7. Three (3) Week Look Ahead Schedule. The Prime Contractor shall prepare report, submit and maintain the Construction Schedule, on a weekly or regular basis, by submitting a Three (3) Week Look Ahead Schedule at Project Meetings. The Three (3) Week Look Ahead Schedule shall provide additional definition of manpower, activities and sequencing to those identified on the Construction Schedule. The form, content and extent of detail in the Contractor prepared Three (3) Week Look Ahead Schedules shall be as required by the Project Manager. The Project Manager shall assimilate each of the various Contractors' Three (3) Week

Look Ahead Schedules into an overall Project Three (3) Week Look Ahead Schedule and issue it at the following Project Meeting to utilize as a comparison of progress against the most recent Construction Schedule. Failure of the Prime Contractor to provide a Three (3) Week Look Ahead Schedule may be deemed by the District as the Prime Contractor's default in the performance of a material obligation under Contract Documents.

7.3.8. **Cost of Scheduling**. Any and all costs or expenses required or incurred to prepare, submit, maintain, and update the Construction, Recovery or Three (3) Week Look Ahead Schedules shall be solely that of the Prime Contractor without adjustment of the Contract Price. The Contract Price shall not be subject to adjustment on account of costs, fees or expenses incurred or associated with the Prime Contractor's preparation, submittal, and maintenance or updating of the Bid Package Construction Schedules. If the Prime Contractor does not comply with this District's request for an updated schedule, the District may have the update completed by others at the Prime Contractor's expense. In such event, the updated Construction Schedule shall be deemed binding upon the Prime Contractor and the District may deduct all costs, fee or expenses in preparing such updated Construction Schedule(s) from any portion of the Contract Price then or thereafter due the Prime Contractor.

7.3.9. **Scheduling Software & Requirements.** Unless otherwise provided in the Special Conditions, the Construction Schedules required under this Article 7 shall; (i) be prepared with a commercially available computer software program in a critical path format; (ii) indicate the date(s) for commencement and completion of various portions of the Work of the Bid Package including without limitation, procurement, fabrication and delivery of major items, materials or equipment; (iii) indicate manpower (estimated men per day) and other resources required for completion of each schedule activity; (iv) indicate costs for completion of each schedule activity; (v) identify each Submittal required by the Contract Documents, the date for the Prime Contractor's submission of each Submittal and the date for the return of the reviewed Submittal to the Prime Contractor.

7.3.10. **Float.** If the Construction Schedules required under this Article 7 incorporate therein any "float" time, such float shall be deemed to jointly belong to and owned by the District and the prime Contractor. As used herein, "float time" shall be deemed to refer to the time between earliest finish date and the latest finish date of each activity shown on the Construction Schedule. If the construction progress is ahead of schedule based on the Construction Schedule(s) and a delay is encountered (even if such delay is a District caused delay), no compensation of any type will be due the Prime Contractor and the District may claim float days equal to the delay until such float days are exhausted and the delay extends the overall project substantial completion date.

7.3.11. **Contractor Schedule Responsibility.** The Prime Contractor is responsible for prosecuting the Work in accordance with the then most current Updated

Construction Schedule. The Prime Contractor shall be liable to the District for all consequences of its delayed completion of the Work or portions thereof, including without limitation, liability for: (a) all costs, expenses or other charges (including direct, indirect, and/or administrative) incurred by Prime Contractor in furnishing such materials, labor, equipment or services necessary to recover and/or maintain progress of the Work in accordance with the then current Construction Schedule and Milestone Schedule; (b) assessment and withholding of Liquidated Damages for delayed Substantial Completion of the Work of the Bid Package or portions of the Work of the Bid Package, as set forth in the Special Conditions; and (c) costs, losses, expenses, damages, claims or other demands asserted by other contractors for other Bid Packages ("Other Contractors") and/or the District's Engineer, Project Manager, Project Inspectors and/or testing and inspection consultants, the progress of which are delayed, interrupted, hindered or otherwise impacted by the Prime Contractor's failure to complete the Work in accordance with the then most current Updated Construction Schedule. The obligation of the Prime Contractor and the Contractor's Performance Bond Surety to defend, indemnify and hold harmless the Indemnified Parties, as set forth in Article 6.8 of the General Conditions, shall be deemed to include requests for equitable adjustment, claims, demands, actions, causes of actions or proceedings initiated by Other Contractors based in whole or in part on the delays of the Prime Contractor in completing the Work of the Contractor's Bid Package, or portions thereof, in accordance with the then most current Updated Construction Schedule.

7.3.12. Additional Requirements. Refer to Section 01 2000 Schedules and Payments of the Project Manual for additional requirements.

7.4. Adjustment of Contract Time. If Substantial Completion is delayed, adjustment, if any, to the Contract Time on account of such delay shall be in accordance with this Article 7.4.

7.4.1. Excusable Delays. If Substantial Completion of the Work is delayed by Excusable Delays, the Contract Time shall be subject to adjustment for such reasonable period of time as determined by the Engineer; Excusable Delays shall not result in any increase in the Contract Price. Excusable Delays refer to unforeseeable and unavoidable casualties or other unforeseen causes beyond the control, and without fault or neglect, of the Prime Contractor, any Subcontractor, Material Supplier or other person directly or indirectly engaged by the Prime Contractor in performance of any portion of the Work. Excusable Delays include unanticipated and unavoidable labor disputes, unusual and unanticipated delays in transportation of equipment, materials or Construction Equipment reasonably necessary for completion and proper execution of the Work, and unanticipated unusually severe weather conditions. Neither the financial resources of the Prime Contractor or any person or entity directly or indirectly engaged by the Prime Contractor in performance of any portion of the Work shall be deemed conditions beyond the control of the Prime Contractor. If an event of Excusable Delay occurs, the Contract Time shall be subject to adjustment hereunder only if the Prime

Contractor establishes: (i) full compliance with all applicable provisions of the Contract Documents relative to the method, manner and time for Prime Contractor's notice and request for adjustment of the Contract Time; (ii) that the event(s) forming the basis for Prime Contractor's request to adjust the Contract Time are outside the reasonable control and without any fault or neglect of the Prime Contractor or any person or entity directly or indirectly engaged by Prime Contractor in performance of any portion of the Work; and (iii) that the event(s) forming the basis for Prime Contractor's request to adjust the Contract Time directly and adversely impacted the progress of the Work as indicated in the Approved Construction Schedule or the most recent updated Approved Construction Schedule relative to the date(s) of the claimed event(s) of Excusable Delay. The foregoing provisions notwithstanding, if the Special Conditions set forth a number of "Rain Days" to be anticipated during performance of the Work, the Contract Time shall not be adjusted for rain related unusually severe weather conditions until and unless the actual number of Rain Days during performance of the Work shall exceed those noted in the Special Conditions and such additional Rain Days shall have directly and adversely impacted the progress of the Work as depicted in the Approved Construction Schedule or the most recent updated Approved Construction Schedule relative to the date(s) of such additional Rain Days.

7.4.2. **Compensable Delays.** If Substantial Completion of the Work is delayed and such delay is caused by the acts or omissions of the District, the Engineer, or separate contractor employed by the District (collectively "Compensable Delays"), upon Prime Contractor's request and notice, in strict conformity with Articles 7 and 9 of these General Conditions, the Contract Time will be adjusted by Change Order for such reasonable period of time as determined by the Engineer and the District. In accordance with California Public Contract Code §7102, if the Prime Contractor's progress is delayed by any of the events described in the preceding sentence, Prime Contractor shall not be precluded from the recovery of damages directly and proximately resulting there from, provided that the District is liable for the delay, the delay is unreasonable under the circumstances involved and the delay was not within the reasonable contemplation of the District and the Prime Contractor at the time of execution of the Agreement. In such event, Prime Contractor's damages, if any, shall be limited to direct, actual and unavoidable additional costs of labor, materials or Construction Equipment directly resulting from such delay, and shall exclude indirect or other consequential damages. Except as expressly provided for herein, Prime Contractor shall not have any other claim, demand or right to adjustment of the Contract Price arising out of delay, interruption, hindrance or disruption to the progress of the Work. Adjustments to the Contract Price and the Contract Time, if any, on account of Changes to the Work or Suspension of the Work shall be governed by the applicable provisions of the Contract Documents, including without limitation, Articles 9 and 14 of these General Conditions.

7.4.3. Inexcusable Delays. Inexcusable Delays refer to any delay to the progress of the Work caused by events or factors other than those specifically identified in Articles 7.4.1 and 7.4.2 above. Neither the Contract Price nor the Contract Time shall be adjusted on account of Inexcusable Delays.

7.4.4. Adjustment of Contract Time.

7.4.4.1. Procedure for Adjustment of Contract Time. The Contract Time shall be subject to adjustment only in strict conformity with applicable provisions of the Contract Documents. Failure of Prime Contractor to request adjustment(s) of the Contract Time in strict conformity with applicable provisions of the Contract Documents shall be deemed Prime Contractor's waiver of the same.

7.4.4.2. Limitations upon Adjustment of Contract Time on Account of Delays. Any adjustment of the Contract Time on account of an Excusable Delay or a Compensable Delay shall be limited as set forth herein. If an Inexcusable Delay and a Compensable Delay occur concurrently, the maximum extension of the Contract Time shall be the number of days from the commencement of the first delay to the cessation of the delay which ends last. If an Inexcusable Delay occurs concurrently with either an Excusable Delay or a Compensable Delay, the maximum extension of the Contract Time shall be the number of days, if any, which the Excusable Delay or the Compensable Delay exceeds the period of time of the Inexcusable Delay. In addition to the foregoing limitations upon extension of the Contract Time, no adjustment of the Contract Time shall be made on account of any Excusable Delays or Compensable Delays unless such delay(s) actually and directly impact Work or Work activities on the critical path of the then current and updated Approved Construction Schedule as of the date on which such delay first occurs. The District shall not be deemed in breach of, or otherwise in default of any obligation hereunder, if the District shall deny any request by the Prime Contractor for an adjustment of the Contract Time for any delay which does not actually and directly impact Work or Work activities on the then current and updated Approved Construction Schedule.

7.5. Liquidated Damages. Should the Contractor neglect, fail or refuse to: (i) submit Submittals in accordance with the Approved Construction Schedule or Updated Construction Schedule, as applicable; (ii) achieve Substantial Completion of the Work within the Contract Time, (subject to adjustments authorized under the Contract Documents); (iii) achieve completion of certain phases thereof or milestones as required by the Approved Construction Schedule or (iv) complete Punch list items within the time established pursuant to the Contract Documents, the Contractor agrees to pay to the District the amount of per diem Liquidated Damages set forth in the Special Conditions, not as a penalty but as Liquidated Damages, for every day beyond the Contract Time, as adjusted, until Submittals are submitted, Substantial Completion or completion of the Punch list items are

achieved. The Liquidated Damages amounts set forth in the Special Conditions are agreed upon by and between the Contractor and the District because of the difficulty of fixing the District's actual damages in the event of delayed submission of Submittals, Substantial Completion or completion of Punch list items. The Contractor and the District specifically agree that said amounts are reasonable estimates of the District's damages in such event, and that such amounts do not constitute a penalty. Liquidated Damages may be deducted from the Contract Price then or thereafter due the Contractor. The Contractor and the Surety shall each be jointly and severa1ly liable to the District for any Liquidated Damages exceeding any amount of the Contract Price then held or retained by the District, provided that liability of the Surety to the District shall be limited to the penal sum of the Performance Bond. In the event that the Contractor shall fail or refuse to complete Punch list items and the District elects to exercise its right to cause completion or correction of such items pursuant to Article 7.2.3.2 hereof, the District's assessment of Liquidated Damages pursuant to the foregoing shall be in addition to, and not in lieu of, the District's right to charge Contractor with the cost of completing or correcting such items of the Work, as provided for under Article 7.2.3.2. Moreover, the District's assessment of Liquidated Damages shall not limit or reduce damages available to the District for Contractor's delay to other contractors. The Contractor and the District acknowledge and agree that the provisions of this Article 7.5 are reasonable under the circumstances existing at the time of the Contractor's execution of the Agreement.

7.6. District Right to Take-Over Work.

7.6.1. Progress of Work. If the Contractor fails or refuses, for any reason and at any time, to provide sufficient materials, labor, equipment, tools and services to maintain progress of the Work in accordance with the then current Construction Schedule, the District may correct such failure(s), after seventy-two (72) hour advance written notice of same from the District to the Contractor. Upon such notice, District may, in its sole discretion, takeover the Work or any portion thereof and thereafter diligently continue to completion or, in the alternative, supplement Contractor's materials, labor, equipment, tools and services to maintain progress of the Work in accordance with the then current Construction Schedule.

7.6.2. District's Right to Withhold. All costs, expenses or other charges incurred by the District in connection with completing or supplementing the Work under this Article 7.6 shall be at the sole cost of the Contractor. District shall be entitled to deduct from the Contract Price then or thereafter due Contractor, all such costs, expenses, and charges, including costs for any additional services the District's representatives and consultants made necessary thereby. If the Contract Price then or thereafter due the Contractor is insufficient to cover such amounts, Contractor shall pay the additional sum to the District promptly upon demand therefor. The assessment and/or withholding of the amount of such costs, expenses, and/or other charges shall be in addition to, and not in lieu of, any Liquidated Damages assessed and/or withheld from Contractor under Article 7.5 hereof.

7.6.3. Non-Exclusive Remedy. The District's exercise of rights pursuant to the foregoing shall not be deemed a waiver or limitation of any other right or remedy of the District under the Contract Documents or the Laws.

ARTICLE 8: CONTRACT PRICE

8.1. Contract Price. The Contract Price is the amount stated in the Agreement as such, and subject to any authorized adjustments thereto in accordance with the Contract Documents, is the total amount payable by the District to the Prime Contractor for performance of the Work under the Contract Documents. The District's payment of the Contract Price to the Prime Contractor shall be in accordance with the Contract Documents. In addition to the conditions precedent set forth in Article 8.3.4.1 to the Contractor's right to receive a Progress Payment and the District's obligation to disburse a Progress Payment, additional conditions precedent to the Contractor's right to receive Progress Payments and the District's obligation to disburse Progress Payments shall be: (i) the Contractor's completion, execution and filing of DSA Form 102; and (ii) the Contractor's completion and execution of the Internal Revenue Service W -9 form, in strict conformity with the Internal Revenue Service rules and regulations relating thereto, along with submittal of the completed, executed form of W-9 to the District.

8.2. Cost Breakdown; Cash Flow Projections. Within fifteen (15) days of the execution of the Agreement by Prime Contractor, Prime Contractor shall furnish, on forms provided or approved by the District, a detailed estimate and complete Cost Breakdown of the entire Contract Price. The Cost Breakdown shall be subject to the District's review and approval of the form and content thereof; in addition to other requirements relating to the Cost Breakdown, the items included therein shall be organized consistent with the CSI format, shall correlate with activities described in the Construction Schedule, and shall include separate items and costs for: mobilization, bond premiums, general conditions and Prime Contractor's fee. In the event that the District shall reasonably object to any portion of the Cost Breakdown, within ten (10) days of the District's receipt of the Cost Breakdown, the District shall notify the Prime Contractor, in writing of the District's objection(s) to the Cost Breakdown. Within five (5) days of the date of the District's written objection(s), Prime Contractor shall submit a revised Cost Breakdown to the District for review and approval. The foregoing procedure for the preparation, review and approval of the Cost Breakdown shall continue until the District has approved of the entirety of the Cost Breakdown. Once the Cost Breakdown is approved by the District, the Cost Breakdown shall not be thereafter modified or amended by the Prime Contractor without the prior consent and approval of the District, which may be granted or withheld in the sole reasonable discretion of the District. Notwithstanding any provision of the Contract Documents to the contrary, payment of the Prime Contractor's overhead, supervision and general conditions costs and profit, as such items are reflected in the Cost Breakdown, shall be made by the District in equal installments with its disbursements of Progress Payments and the Final Payment with the amount of each such installment equal to the aggregate amount of such items as reflected in the Cost Breakdown divided by the number of months of the Contract Time. Upon request of the District, the Prime Contractor shall provide reasonably satisfactory evidence to substantiate the cost of any item included in the Cost Breakdown. Concurrently with submittal of its Cost Breakdown, the Prime Contractor sha1l submit for review and approval a Cash Flow Projection on a monthly basis over the Contract Time duration for the entire Contract Price. The Cash Flow Projection shall be revised to take into account-authorized adjustments of the Contract Time or the Contract Price.

8.3. Progress Payments.

8.3.1. Applications for Progress Payments. During the Prime Contractor's performance of the Work, the Prime Contractor shall submit monthly, on the first working day of each month, to the Project Manager and the Engineer, Applications for Progress Payments, on forms approved by the District, setting forth an itemized estimate of Work completed in the preceding month for the purpose of the District's making of Progress Payments thereon. Values utilized in the Applications for Progress Payments shall be based upon the District approved Cost Breakdown pursuant to Article 8.2 above and such values shall be only for determining the basis of Progress Payments to Prime Contractor, and shall not be considered as fixing a basis for adjustments, whether additive or deductive, to the Contract Price, or for determining the extent of Work actua1ly completed.

8.3.2. District's Review of Applications for Progress Payments. In accordance with Public Contract Code §20104.50, upon receipt of an Application for Progress Payment, the District shall cause the same to be reviewed by the District's Inspector, the Project Manager, if one is designated by the District, and the Engineer, as soon as is practicable after receipt of such Application for Progress Payment. Such review shall be for the purpose of determining that the Application for Progress Payment is a proper Progress Payment request. For purposes of this Article 8.3.2, an Application for Progress Payment shall be deemed "proper" only if it is submitted on the form approved by the District, with all of the requested information of such form of Application for Progress Payment completely and accurately provided by the Prime Contractor and such completed Application for Progress Payment is accompanied by: (i) Certified Payrolls of the Prime Contractor and all Subcontractors, of any tier, for laborers performing any portion of the Work for which a Progress Payment is requested; (ii) duly completed and executed forms of Conditional Waiver and Release of Rights Upon Progress Payment in accordance with California Civil Code §3262 of the Prime Contractor, all Subcontractors of any tier, and Material Suppliers covering the Progress Payment requested; (iii) duly completed and executed forms of Unconditional Waiver and Release of Rights upon Progress Payment in accordance with California Civil Code §3262 of the Prime Contractor, all Subcontractors of any tier, and Material Suppliers covering the Progress Payment received by the Prime Contractor under the prior Application for Progress Payment; (iv) if applicable, a current union statement reflecting that the Prime Contractor and any Subcontractor of any tier, are current in the payment of any supplemental fringe benefits required pursuant to any collective bargaining agreement to which the Prime Contractor or any such Subcontractor is a party to or is otherwise bound by; and (v) a certification by the Prime Contractor that it has continuously maintained, or caused to be maintained, the Record Drawings reflecting the actual as-built conditions of the Work performed be for which the Progress Payment is requested, it being understood that such certification is subject to verification by the District, Engineer or the Project Manager prior to

disbursement of the Progress Payment. In accordance with Public Contract Code §20104.50, an Application for Progress Payment determined by the District not to be a proper Application for Progress Payment shall be returned by the District to the Prime Contractor as soon as is practicable after receipt of the same from the Prime Contractor, but in no event not more than seven (7) days after the District's receipt thereof. The District's return of any Application for Progress Payment pursuant to the preceding sentence shall be accompanied by a written document setting forth the reason(s) why the Application for Progress Payment is not proper.

8.3.3. Engineer's, Project Manager's, and District's Inspector Review of Applications for Progress Payments. Upon receipt of an Application for Progress Payment, the Engineer, Project Manager, and the District's Inspector shall inspect and verify the Work to determine whether it has been performed in accordance with the terms of the Contract Documents and to determine the portion of the Application for Progress Payment which is properly due to the Prime Contractor under the terms of the Contract Documents.

8.3.4. District's Disbursement of Progress Payments.

8.3.4.1. Timely Disbursement of Progress Payments. In accordance with Public Contract Code §20l04.50, within thirty (30) days after the District's receipt of a proper Application for Progress Payment, there shall be paid, by District, to Prime Contractor a sum equal to ninety percent (90%) of the value of the Work indicated in the Application for Progress Payment which is actually in place as of the date of the Application for Progress Payment and as verified and approved by the District's Inspector and the Engineer and the pro rata portion of the Prime Contractor's overhead, supervision and general conditions costs and profit for that month; provided, however, that the District's obligation to disburse any Progress Payment shall be subject to the District's receipt of all documents set forth in Article 8.3.2 above, each and all of which are conditions precedent to the District's obligation to disburse Progress Payments. If an Application for Progress Payment is determined not to be proper due to the failure or refusal of the Prime Contractor to submit documents with the Application for Progress Payment, as required by Article 8.3.2, or incompleteness or inaccuracies in any such documents submitted or if it is reasonably determined that the Record Drawings have not been continuously maintained to reflect the actual as built conditions of the Work completed in the period for which the Progress Payment is requested, the thirty (30) day period hereunder for the District's timely disbursement of a Progress Payment shall be deemed to commence on the date that the District is actually in receipt of documents not submitted with the Application for Progress Payment, or corrections to documents with the Application for Progress Payment so as to

render them complete and accurate, or the date upon which the Prime Contractor accurately and fully completes preparation of the Record Drawings relating to the Work for which the Progress Payment is requested.

8.3.4.2. Untimely Disbursement of Progress Payments. In accordance with Public Contract Code §20104.50, in the event that the District shall fail to make any Progress Payment within thirty (30) days after receipt of an undisputed and properly submitted Application for Progress Payment, the District shall pay the Prime Contractor interest on the undisputed amount of such Application for Progress Payment equal to the legal rate of interest set forth in California Code of Civil Procedure §685.010(a). The foregoing notwithstanding, in the event that the District shall determine that any Application for Progress Payment is not proper, pursuant to Article 8.3.2 above, and the District does not return such Application for Progress Payment within the seven (7) day period provided for in Article 8.3.2, the period of time for the District's disbursement of the Progress Payment on such Application for Progress Payment without incurring the interest liability shall be reduced by the number of days exceeding the seven (7) day return period.

8.3.4.3. District's Right to Disburse Progress Payments by Joint Checks. Provided that the District is in receipt of the applicable Subcontract or Purchase Order, the District, may in its sole discretion, issue joint checks to the Prime Contractor and such Subcontractor or Material Supplier in satisfaction of its obligation to make Progress Payments or the Final Payment due hereunder.

8.3.4.4. No Waiver of Defective or Non-Conforming Work. The approval of any Application for Progress Payment or the disbursement of any Progress Payment to the Prime Contractor shall not be deemed nor constitute acceptance of defective Work or Work not in conformity with the Contract Documents.

8.3.5. Progress Payments for Changed Work. The Prime Contractor's Applications for Progress Payment may include requests for payment on account of Changes in the Work which have been properly authorized and approved by the District's Inspector, the Engineer and all other governmental agencies with jurisdiction over such Change in accordance with the terms of the Contract Documents and for which a Change Order has been issued. Except as provided for herein, no other payment shall be made by the District for Changes in the Work.

8.3.6. Materials or Equipment Not Incorporated Into the Work.

8.3.6.1. Limitations upon Payment. Except as expressly provided for herein, no payments shall be made by the District on account of any item of the Work, including without limitation, materials or equipment which, at the time of the Prime Contractor's submittal of an Application for Progress Payment, has/have not been incorporated into and made a part of the Work.

8.3.6.2. Materials or Equipment Delivered and Stored at the Site. The District may, in its sole and exclusive discretion, make payment for materials or equipment not yet incorporated into the Work if, at or prior to the time of the Prime Contractor's submittal of a an Application for Progress Payment incorporating therein a request for payment of such materials or equipment if all of the following are complied with: (a) the materials or equipment have been delivered to the Site; (b) adequate arrangements, reasonably satisfactory to the District, have been made by the Prime Contractor to store and protect such materials or equipment at the Site including without limitation, insurance reasonably satisfactory to the District, covering and protecting against the risk of loss, destruction, theft or other damage to such materials or equipment while in storage; and (c) the establishment of procedures reasonably satisfactory to the District by which title to such materials or equipment will be vested in the District upon the District's payment therefore. The Prime Contractor acknowledges that the discretion to make, or not to make, payment for materials or equipment delivered or stored at the site of the Work pursuant to the preceding sentence shall be exercised exclusively by the District; the District's exercise of discretion not to make payment for materials or equipment delivered or stored at the Site, but not yet incorporated into the Work shall not be deemed the District's default hereunder. In the event that the District shall elect to make payment for materials or equipment delivered and stored at the Site, the costs and expenses incurred to comply with the requirements of (b) and (c) of this Article 8.3.6.2 shall be borne solely and exclusively by the Prime Contractor and no payment shall be made by the District on account of such costs and expenses.

8.3.6.3. Materials or Equipment Not Delivered or Stored at the Site. No payments shall be made by the District for materials or equipment to be incorporated into the Work where such materials or equipment have not been delivered or stored at the Site. The foregoing notwithstanding, the District may, in its sole and exclusive discretion, elect to make payment for materials or equipment not incorporated into the Work and which are not delivered or stored at the Site at or prior to the time of the Prime Contractor's submittal of an Application

for Progress Payment incorporating therein a request for payment of such materials or equipment provided that each and all of the following have been complied with: (a) adequate arrangements, reasonably satisfactory to the District, have been made by the Prime Contractor to store and protect such materials or equipment at a bonded warehouse, and which arrangements shall include without limitation, insurance reasonably satisfactory to the District, covering and protecting against the risk of loss, destruction, theft or other damage to such materials or equipment while in storage; and (b) the establishment of procedures reasonably satisfactory to the District by which title to such materials or equipment will be vested in the District upon the District's payment therefore. The Prime Contractor acknowledges that the discretion to make, or not to make, payment for such materials or equipment delivered or stored at a bonded warehouse pursuant to the preceding sentence shall be exercised exclusively by the District; the District's exercise of discretion not to make payment for such materials or equipment shall not be deemed the District's default hereunder. In the event that the District shall elect to make payment for materials or equipment delivered and stored at a bonded warehouse, the costs and expenses incurred to comply with the requirements of (a) and (b) of this Article 8.3.6.3 shall be borne solely and exclusively by the Prime Contractor and no payment shall be made by the District on account of such costs and expenses.

8.3.6.4. Materials or Equipment in Fabrication or Transit. The provisions of this Article 8.3.6 notwithstanding, the District shall not make any payment on account of any materials or equipment which is in the process of being fabricated or which are in transit to the Site of or other storage location.

8.3.7. Exclusions from Progress Payments. In addition to the District's right to withhold disbursement of any Progress Payment provided for in the Contract Documents, neither the Prime Contractor's Application for Progress Payment sha1l include, nor shall the District be obligated to disburse any portion of the Contract Price for amounts which the Prime Contractor does not intend to pay any Subcontractor, of any tier, or Material Supplier because of a dispute or any other reason.

8.3.8. Title to Work. The Prime Contractor warrants that title to all Work covered by an Application for Progress Payment will pass to the District no later than the time of payment. The Prime Contractor further warrants that upon submittal of an Application for Progress Payment, all Work for which a Progress Payment has been previously issued and the Prime Contractor has received payment from the District therefore shall, to the best of the Prime Contractor's knowledge, information and belief, be free and clear of liens, claims, stop notices, security interests or encumbrances in favor of the Prime Contractor, Subcontractors,

Material Suppliers or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

8.3.9. Substitute Security for Retention. In accordance with the provisions of California Public Contract Code §22300, eligible and equivalent securities may be substituted for any monies withheld by the District to ensure the Prime Contractor's performance under the Contract Documents at the request and expense of the Prime Contractor and in conformity with the provisions of California Public Contract Code §22300. The foregoing and the provisions of California Public Contract Code §22300 notwithstanding, failure of the Prime Contractor to request the substitution of eligible and equivalent securities for monies to be withheld by the District prior to submission of the first Application for Progress Payment shall be deemed a waiver of such right.

8.4. Final Payment.

8.4.1. Application for Final Payment. When the Prime Contractor has achieved Final Completion and Acceptance of the entire Work and has otherwise fully performed its obligations under the Contract Documents, the Prime Contractor shall submit an Application for Final Payment on such form as approved by the District. Thereupon, the Engineer and the District's Inspector will promptly make a final inspection of the Work and when the Engineer and the District's Inspector find the Work acceptable under the Contract Documents and that the Contract has been fully performed by the Prime Contractor, the Engineer and the District's Inspector will thereupon promptly approve the Application for Final Payment, stating that to the best their knowledge, information and belief, the Work on the entire Project has been fully completed in accordance with the terms of the Contract Documents. The Final Payment shall include the remaining balance of the Contract Price and any retention from Progress Payments previously withheld by the District.

8.4.2. Conditions Precedent to Disbursement of Final Payment. Neither Final Payment nor any remaining Contract Price shall become due until the Prime Contractor submits to the District each and all of the following, the submittal of which are conditions precedent to the District's obligation to disburse the Final Payment: (i) an affidavit or certification by the Prime Contractor that payrolls, bills for materials and other indebtedness incurred in connection with the Work for which the District or the District's property may or might be responsible or encumbered have been paid or otherwise satisfied; (ii) a certificate evidencing that insurance required by the Contract Documents to remain in force after the Prime Contractor's receipt of Final Payment is currently in effect; (iii) a written statement that the Prime Contractor knows of no substantial reason that the insurance will not be renewable to cover any period following Final Payment as required by the Contract Documents; (iv) consent of the Surety on the Labor and Material Payment Bond and Performance Bond, to Final Payment if required; (v) du1y completed and executed forms of Conditional or Unconditional Waivers

and Releases of rights upon Final Payment of the Prime Contractor, Subcontractors of any tier and Material Suppliers in accordance with California Civil Code §3262, with each of the same stating that there are, or will be, no claims for additional compensation after disbursement of the Final Payment; (vi) Operations and Maintenance manuals and separate warranties provided by any manufacturer or distributor of any materials or equipment incorporated into the Work; (vii) the Record Drawings; (viii) the form of Guarantee included in the Contract Documents du1y executed by an authorized representative of the Prime Contractor; (ix) all other items or documents required by the Contract Documents to be delivered to the District upon completion of the Work; (x) if required by the District, such other data establishing payment or satisfaction of obligations such as receipts, releases and waivers of liens, stop notices, claims, security interest or encumbrances arising out of the Contract to the extent and in such form as may be required by the District; and (xi) the Contractor's completion and filing of DSA Form 6.

8.4.3. Disbursement of Final Payment. Provided that the District is then in receipt of all documents and other items in Article 8.4.2 above as conditions precedent to the District's obligation to disburse Final Payment, not later than sixty (60) days following Final Acceptance the District shall disburse the Final Payment to the Prime Contractor. Pursuant to California Public Contract Code §7107, if there is any dispute between the District and the Prime Contractor at the time that disbursement of the Final Payment is due, the District may withhold from disbursement of the Final Payment an amount not to exceed one hundred fifty percent (150%) of the amount in dispute.

8.4.4. Waiver of Claims. The Prime Contractor's acceptance of the Final Payment shall be deemed a waiver and release by the Prime Contractor of any and all claims against the District for compensation or otherwise in connection with the Prime Contractor's performance of the Contract.

8.4.5. Claims Asserted After Final Payment. Any lien, stop notice or other claim filed or asserted after the Prime Contractor's acceptance of the Final Payment by any Subcontractor, of any tier, laborer, Material Supplier or others in connection with or for Work performed under the Contract Documents shall be the sole and exclusive responsibility of the Prime Contractor who further agrees to indemnify, defend and hold harmless the District and its officers, agents, representatives and employees from and against any claims, demands or judgments arising or associated therewith, including without limitation attorney’s fees incurred by the District in connection therewith. In the event any lien, stop notice or other claim of any Subcontractor, Laborer, Material Supplier or others performing Work under the Contract Documents remain unsatisfied after Final Payment is made, Prime Contractor shall refund to District all monies that the District may pay or be compelled to pay in discharging any lien, stop notice or other claim, including, without limitation all costs and reasonable attorney’s fees incurred by District in connection therewith.

8.5. Withholding of Payments. The District may withhold any Progress Payment or the Final Payment, in whole or in part, or back charge the Prime Contractor to the extent it may deem advisable to protect the District on account of: (i) defective Work or Work not in conformity with the requirements of the Contract Documents which is not remedied; (ii) failure of the Prime Contractor to make payments when due Subcontractors or Material Suppliers for materials or labor; (iii) claims filed or reasonable evidence of the probable filing of claims by Subcontractors, laborers, Material Suppliers, or others performing any portion of the Work under the Contract Documents for which the District may be liable or responsible including, without limitation, Stop Notice Claims filed with the District pursuant to California Civil Code §3179 et. seq.; (iv) a reasonable doubt that the Contract can be completed for the then unpaid balance of the Contract Price; (v) tax demands filed in accordance with California Government Code §12419.4; (vi) other claims, penalties and/or forfeitures for which the District is required or authorized to retain funds otherwise due the Prime Contractor; (vii) any amounts due from the Prime Contractor to the District under the terms of the Contract Documents; or (viii) the Prime Contractor's failure to perform any of its obligations under the Contract Documents or its defau1t under the Contract Documents or its failure to maintain adequate progress of the Work. In addition to the foregoing, the District shall not be obligated to process any Application for Progress Payment or Final Payment, nor shall Prime Contractor be entitled to any Progress Payment or Final Payment so long as any lawful or proper direction concerning the Work or the performance thereof or any portion thereof, given by the District, the District's Inspector, the Engineer or any public authority having jurisdiction over the Work, or any portion thereof, shall not be fully and completely complied with by the Prime Contractor. When the District is reasonably satisfied that the Prime Contractor has remedied any such deficiency, payment shall be made of the amount withheld.

8.6. Payments to Subcontractors. The Prime Contractor shall pay all Subcontractors for and on account of Work of the Contract performed by such Subcontractors in accordance with the terms of their respective subcontracts and as provided for pursuant to California Public Contract Code §10262, the provisions of which are deemed incorporated herein by this reference. In the event of the Prime Contractor's failure to make payment to Subcontractors in conformity with California Public Contract Code §10262, the provisions of California Public Contract Code §10253 shall apply; by this reference, the provisions of California Public Contract Code §10253 are incorporated herein in its entirety, except that the references in said Section 10253 to "the director" shall be deemed to refer to the District.

ARTICLE 9: CHANGES

9.1. Changes in the Work. The District, at any time, by written order, may make Changes within the general scope of the Work under the Contract Documents or issue additional instructions; require additional Work or direct deletion of Work. The Prime Contractor shall not proceed with any Change involving an increase or decrease in the Contract Price or the Contract Time without prior written authorization from the District. The foregoing notwithstanding, the Prime Contractor shall promptly commence and diligently complete any Change to the Work subject to the District's written authorization issued pursuant to the preceding sentence; the Prime Contractor shall not be relieved or excused from its prompt commencement and diligent completion of any Change subject

to the District's written authorization by virtue of the absence or inability of the Prime Contractor and the District to agree upon the extent of any adjustment to the Contract Time or the Contract Price on account of such Change. The issuance of a Change Order pursuant to this Article 9 in connection with any Change authorized by the District under this Article 9.1 shall not be deemed a condition precedent to Prime Contractor's obligation to promptly commence and diligently complete any such Change authorized by the District hereunder. The District's right to make Changes shall not invalidate the Contract nor relieve the Prime Contractor of any liability or other obligations under the Contract Documents. Any requirement of notice of Changes in the scope of Work to the Surety shall be the responsibility of the Prime Contractor. Changes to the Work depicted or described in the Drawings or the Specifications shall be subject to approval by the DSA. The District may make Changes to bring the Work or the Project into compliance with environmental requirements or standards established by state or federal statutes and regulations enacted after award of the Contract.

9.2. Oral Order of Change in the Work. Any oral order, direction, instruction, interpretation, or determination from the District, the District's Inspector or the Engineer which in the opinion of the Prime Contractor causes any change to the scope of the Work, or otherwise requires an adjustment to the Contract Price or the Contract Time, shall be treated as a Change only if the Prime Contractor gives the Engineer and the District's Inspector written notice within ten (10) days of the order, directions, instructions, interpretation or determination and prior to acting in accordance therewith. Time is of the essence in Prime Contractor's written notice pursuant to the preceding sentence so that the District can promptly investigate and consider alternative measures to address the order, direction, instruction, interpretation or determination-giving rise to Prime Contractor's notice. Accordingly, Prime Contractor acknowledges that its failure, for any reason, to give written notice within ten (10) days of such order, direction, instruction, interpretation or determination shall be deemed Prime Contractor's waiver of any right to assert or claim any entitlement to an adjustment of the Contract Time or the Contract Price on account of such order, direction, instruction, interpretation or determination. The written notice shall state the date, circumstances, extent of adjustment to the Contract Price or the Contract Time, if any, requested, and the source of the order, directions, instructions, interpretation or determination that the Prime Contractor regards as a Change. Unless the Prime Contractor acts in strict accordance with this procedure, any such order, direction, instruction, interpretation or determination shall not be treated as a Change and the Prime Contractor hereby waives any claim for any adjustment to the Contract Price or the Contract Time on account thereof.

9.3. Prime Contractor Submittal of Data. Within thirty (30) days after receipt of a written order directing a Change in the Work or furnishing the written notice regarding any oral order directing a Change in the Work, the Prime Contractor shall submit to the Engineer, the District's Inspector and the District a detailed written statement setting forth the general nature of the Change, the amount of any adjustment to the Contract Price on account thereof, properly itemized and supported by sufficient substantiating data to permit evaluation of the same, and the extent of adjustment of the Contract Time, if any, required by such Change. No claim or adjustment to the Contract Price or the Contract Time shall be allowed if not asserted by the Prime Contractor in strict conformity herewith or if asserted after Final Payment is made under the Contract Documents.

9.4. Adjustment to Contract Price and Contract Time on Account of Changes to the Work.

9.4.1. Adjustment to Contract Price. Adjustments to the Contract Price due to Changes in the Work shall be determined by application of one of the following methods, in the following order of priority:

9.4.1.1. Mutual Agreement. By negotiation and mutual agreement, on a lump sum basis, between the District and the Prime Contractor on the basis of the estimate of the actual and direct increase or decrease in costs on account of the Change. Upon request of the District or the Engineer, the Prime Contractor shall provide a detailed estimate of increase or decrease in costs directly associated with performance of the Change along with cost breakdowns of the components of the Change and supporting data and documentation. The Prime Contractor's estimate of increase or decrease in costs pursuant to the foregoing, if requested, shall be in sufficient detail and in such form as to allow the District, the District's Inspector and the Engineer to review and assess the completeness and accuracy thereof. The Prime Contractor shall be solely responsible for any additional costs or additional time arising out of, or related in any manner to, its failure to provide the estimate of costs within the time specified in the request of the District or the Engineer for such estimate.

9.4.1.2. Application of Saylor Current Construction Costs. By application of the most recent edition of Saylor Current Construction Costs in effect at the time of Prime Contractor's performance of the Change in the Work for the locality of the Site. The Saylor Current Construction Costs shall be applied only to the extent that the Change in the Work is an item of costs specifically set forth in Saylor Construction Costs. In the event that Saylor Current Construction Costs shall cease publication, upon mutual agreement between the District and the Prime Contractor, for purposes of this Article 9.4.1.2, an alternate standardized estimating manual may be utilized in lieu of Saylor Construction Costs, if no mutual agreement is reached between the District and the Prime Contractor regarding the utilization of an alternate estimating manual, adjustments to the Contract Price on account of Changes in the Work shall be determined by application of the methods set forth in Articles 9.4.1.1 or 9.4.1.3 hereof.

9.4.1.3. Determination by the District. By the District, whether or not negotiations are initiated pursuant to Article 9.4.1.1 above based upon actual and necessary costs incurred by the Prime Contractor as determined by the District on the basis of the Prime Contractor's records. In the event that the procedure set forth in this Article 9.4.1.3 is utilized to determine the extent of adjustment to the Contract Price on account of Changes to the Work, promptly upon determining the extent of adjustment to the Contract Price, the District shall notify the

Prime Contractor in writing of the same; the Prime Contractor shall be deemed to have accepted the District's determination of the amount of adjustment to the Contract Price on account of a Change to the Work unless Prime Contractor shall notify the District, the Engineer and the District's Inspector, in writing, not more than fifteen (15) days from the date of the District's written notice, of any objection to the District's determination. Failure of the Prime Contractor to timely notify the District, the Engineer and the District's Inspector of Prime Contractor's objections to the District's determination of the extent of adjustment to the Contract Price shall be deemed Prime Contractor's acceptance of the District's determination and a waiver of any right or basis of the Prime Contractor to thereafter protest or otherwise object to the District's determination. Notwithstanding any objection of the Prime Contractor to the District's determination of the extent of any adjustment to the Contract Price pursuant to this Article 9.4.1.3, Prime Contractor shall, pursuant to Article 9.7 below, diligently proceed to perform and complete any such Change.

9.4.1.4. Basis for Adjustment of Contract Price. In the event of Changes in the Work resulting in an adjustment of the Contract Price and the adjustment of the Contract Price is based upon the methods set forth in Articles 9.4.1.1 or 9.4.1.3 above, the basis for adjustment of the Contract Price shall be as follows:

9.4.1.4.1. Labor. Prime Contractor shall be compensated for the costs of labor actually and directly utilized in the performance of the Change. Such labor costs shall be limited to field labor for which there is a prevailing wage rate classification. Wage rates for labor shall not exceed the prevailing wage rates in the locality of the Site and shall be in the labor classification(s) necessary for the performance of the Change. Use of a labor classification, which would increase labor costs associated with any Change, shall not be permitted. Labor costs sha1l exclude costs incurred by the Prime Contractor in preparing estimate(s) of the costs of the Change, in the maintenance of records relating to the costs of the Change, coordination and assembly of materials and information relating to the Change or performance thereof, or the supervision and other overhead and general conditions costs associated with the Change or performance thereof.

9.4.1.4.2. Materials and Equipment. Prime Contractor shall be compensated for the costs of materials and equipment necessarily and actually used or consumed in connection

with the performance of Changes. Costs of materials and equipment may include reasonable costs of transportation from a source closest to the site of the Work and delivery to the Site. If discounts by Material Suppliers are available for materials necessarily used in the performance of Changes, they shall be credited to the District. If materials and/or equipment necessarily used in the performance of Changes are obtained from a supplier or source owned in whole or in part by the Prime Contractor, compensation therefore shall not exceed the current wholesale price for such materials or equipment. If, in the reasonable opinion of the District, the costs asserted by the Prime Contractor for materials and/or equipment in connection with any Change is excessive, or if the Prime Contractor fails to provide satisfactory evidence of the actual costs of such materials and/or equipment from its supplier or vendor of the same, the costs of such materials and/or equipment and the District's obligation for payment of the same shall be limited to the then lowest wholesale price at which similar materials and/or equipment are available in the quantities required to perform the Change. The District reserves the right to furnish materials and/or equipment required for the performance of Changes to the Work, in which event the Prime Contractor shall not be compensated for the costs of furnishing such materials and/or equipment or any mark-up thereon.

9.4.1.4.3. Construction Equipment. Prime Contractor shall be compensated for the actual cost of the necessary and direct use of Construction Equipment in the performance of Changes to the Work. Use of such Construction Equipment in the performance of Changes to the Work shall be compensated in increments of fifteen (15) minutes. Rental time for Construction Equipment moved by its own power shall include time required to move such Construction Equipment to the site of the Work from the nearest available rental source of the same. If Construction Equipment is not moved to the Site by its own power, Prime Contractor will be compensated for the loading and transportation costs in lieu of rental time. The foregoing notwithstanding, neither moving time or loading and transportation time shall be allowed if the Construction Equipment is used for performance of any portion of the Work other than Changes to the Work. Unless prior approval in writing

is obtained by the Prime Contractor from the Engineer, the District's Inspector and the District, no costs or compensation shall be allowed for time while Construction Equipment is inoperative, idle or on standby, for any reason. The Prime Contractor shall not be entitled to an allowance or any other compensation for Construction Equipment or tools used in the performance of Changes to the Work where such Construction Equipment or tools have a replacement value of $500.00 or less. Construction Equipment costs claimed by the Prime Contractor in connection with the performance of any Change to the Work shall not exceed rental rates established by distributors or construction equipment rental agencies in the locality of the Site; any costs asserted which exceed such rental rates shall not be allowed or paid. Unless otherwise specifically approved in writing by the Engineer, the District's Inspector and the District, the allowable rate for the use of Construction Equipment in connection with Changes to the Work shall constitute full compensation to the Prime Contractor for the cost of rental, fuel, power, oil, lubrication, supplies, necessary attachments, repairs or maintenance of any kind, depreciation, storage, insurance, labor (exclusive of labor costs of the Construction Equipment operator), and any all other costs incurred by the Prime Contractor incidental to the use of such Construction Equipment.

9.4.1.4.4. Mark-up on Costs of Changes to the Work. In determining the cost to the District and the extent of increase to the Contract Price resulting from a Change adding to the Work, the allowance or mark-ups on the costs of the Change for all overhead (including home office and field overhead), general conditions costs and profit associated with the Change shall not exceed the percentage set forth in the Special Conditions, regardless of the number of Subcontractors, of any tier, performing any portion of any Change to the Work. The foregoing notwithstanding, in the event that the Saylor Current Construction Costs, or a mutually agreed to estimating manual in the event that Saylor Current Construction Costs shall cease publication, is utilized to determine the costs of a Change and the cost computation therein includes an allowance for overhead, general conditions costs and/or profit, the Prime Contractor and any Subcontractor, of any tier, performing any portion of

such Change, shall not be entitled to an allowance for overhead general conditions costs and/or profit beyond that reflected for such item of Change in the Saylor Current Construction Costs or other mutually agreed upon estimating manual. In the event of a Change to the Work resulting in a reduction of the Contract Price, no profit, general conditions or overhead costs shall be paid by the District to the Prime Contractor for the reduced or deleted Work. In such event, the adjustment to the Contract Price shall be the actual cost reduction realized by the reduced or deleted Work multiplied by the percentage set forth in the Special Conditions for mark-ups on the cost of a Change adding to the scope of the Work.

9.4.1.5. Prime Contractor Maintenance of Records. In the event that Prime Contractor shall be directed to perform any Changes to the Work pursuant to Article 9.1 or 9.2, or should the Prime Contractor encounter conditions which the Prime Contractor, pursuant to Article 9.6, believes would obligate the District to adjust the Contract Price and/or the Contract Time, Prime Contractor shall maintain detailed records on a daily basis. Such records shall include without limitation hourly records for labor and Construction Equipment, purchase orders, invoices and bills of lading for all materials and equipment, rental agreements for Construction Equipment, together with itemized records of materials, equipment and Construction Equipment used that day in connection with the performance of any Change to the Work. In the event that more than one Change to the Work is performed by the Prime Contractor in a calendar day, Prime Contractor shall maintain separate records of labor, Construction Equipment, materials and equipment for each such Change. In the event that any Subcontractor, of any tier, shall provide or perform any portion of any Change to the Work, Prime Contractor shall require that each such Subcontractor maintain records in accordance with this Article 9.4.1.5. Each daily record maintained hereunder shall be signed by Prime Contractor's Superintendent or Prime Contractor's authorized representative; such signature shall be deemed Prime Contractor's representation and warranty that all information contained therein is true, accurate, and complete and relate only to the Change referenced therein. All records maintained by a Subcontractor, of any tier, relating to the costs of a Change to the Work shall be signed by such Subcontractor's authorized representative or Superintendent. All records maintained hereunder shall be subject to inspection, review and/or reproduction by the District, the Engineer or the District's Inspector upon request. In the event that Prime Contractor shall fail or refuse, for any reason, to maintain or make available for inspection, review and/or reproduction such records and the adjustment to the Contract Price on account of any Change to

the Work is determined pursuant to Article 9.4.1.5, the District's reasonable good faith determination of the extent of adjustment to the Contract Price on account of such Change shall be final, conclusive, dispositive and binding upon Prime Contractor. Prime Contractor's obligation to maintain records under this Article 9.4.1.5 is in addition to, and not in lieu of, any other Prime Contractor obligation under the Contract Documents with respect to Changes to the Work.

9.4.2. Adjustment to Contract Time. In the event of any Change(s) to the Work pursuant to this Article 9, the Contract Time shall be extended or reduced by Change Order for a period of time commensurate with the time reasonably necessary to perform such Change. In the event that any Change shall require an extension of the Contract Time, the Prime Contractor shall not be subject to Liquidated Damages for such period of time. In the event that completion of the Work is delayed by causes for which the District is responsible and the delay is unreasonable under the circumstances involved, and not within the contemplation of the Prime Contractor and the District at the time of execution of the Agreement, the Prime Contractor shall not be precluded from the recovery of damages arising there from.

9.4.3. Addition or Deletion of Alternate Bid Item(s). In the event that the Bid for the Work includes proposal(s) for Alternate Bid Item(s), during Prime Contractor's performance of the Work, the District may elect, pursuant to this Article to add any such Alternate Bid Item(s) if the same did not form a basis for award of the Contract or delete any such Alternate Bid Item(s) if the same formed a basis for award of the Contract. In the event that the District shall elect to add or delete any such Alternate Bid Item(s), the cost or credit for such Alternate Bid Item(s) shall be as set forth in the Prime Contractor's Bid Proposal.

9.5. Change Orders. If the District approves of a Change, a written Change Order prepared by the Engineer on behalf of the District shall be forwarded to the Prime Contractor describing the Change and setting forth the adjustment to the Contract Time and the Contract Price, if any, on account of such Change. All Change Orders shall be in full payment and final settlement of all claims for direct, indirect and consequential costs, including without limitation, costs of delays or impacts related to, or arising out of, items covered and affected by the Change Order, as well as any adjustments to the Contract Time. Any claim or item relating to any Change incorporated into a Change Order not presented by the Prime Contractor for inclusion in the Change Order shall be deemed waived. The Prime Contractor shall execute the Change Order prepared pursuant to the foregoing; once the Change Order has been prepared and forwarded to the Prime Contractor for execution, without the prior approval of the District which may be granted or withheld in the sole and exclusive discretion of the District, the Prime Contractor shall not modify or amend the form or content of such Change Order, or any portion thereof. The Prime Contractor's attempted or purported modification or amendment of any such Change Order, without the prior approval of the District, shall not be binding upon the District; any such unapproved modification or amendment to such Change Order shall be null, void and unenforceable. Unless otherwise expressly provided for in the Contract Documents or in the Change Order, any Change Order issued hereunder shall be binding upon the

District only upon action of the District's Board of Trustees approving and ratifying such Change Order. In the event of any amendment or modification made by the Prime Contractor to a Change Order for which there is no prior approval by the District, in accordance with the provisions of this Article 9.5, unless otherwise expressly stated in its approval and ratification of such Change Order, any action of the Board of Trustees to approve and ratify such Change Order shall be deemed to be limited to the Change Order as prepared by the Engineer; such approval and ratification of such Change Order shall not be deemed the District's approval and ratification of any unapproved amendment or modification by the Prime Contractor to such Change Order.

9.6. Unilateral Change Orders. A Unilateral Change Order is a Change Order issued by the District before the Prime Contractor and District have agreed on the extent of adjustment of the Contract Time or the Contract Price relating to a Change. The District may, in its sole reasonable discretion, issue a Unilateral Change Order for Changes in the Work approved by the District notwithstanding any failure of the Prime Contractor and the District to reach mutual agreement as to the extent of any adjustment to the Contract Price or Contract Time. The District shall issue a Unilateral Change Order only in the event that the procedure set forth in Article 9.4.1.2 is utilized to determine the extent of adjustment to the Contract Price, the District has notified the Prime Contractor in writing of the District's determination, and the Prime Contractor has notified the District, the Engineer, and the Project Inspector, in writing, not more than fifteen (15) days from the date of the District's written notice of its objection to the District's determination, or the District's determination has been deemed accepted by the Prime Contractor and the Prime Contractor has waived its right to protest or otherwise object to District's determination by failing to notify the District, the Engineer, and the Project Inspector, in writing, not more than fifteen (15) days from the date of the District's written notice of its objection to the District's determination. A Unilateral Change Order shall describe the Change and set forth the adjustment to the Contract Time and Contract Price, if any, and may include, without limitation, direct costs, indirect costs, and/or costs of delay or impact related to, or arising out of, items covered and/or affected by the Change Order. The District shall forward to the Prime Contractor a copy of the proposed Unilateral Change Order at least five (5) days prior to the Board of Trustees' review and consideration of the Unilateral Change Order for information only. Any Unilateral Change Order issued hereunder shall be binding upon the District and Prime Contractor only upon action of the District's Board of Trustees' approval of ratification of same. Any and all claims by the Prime Contractor arising out of such Unilateral Change Order, and/or the Change giving rise to such Unilateral Change Order, shall accrue as of the date of the Board of Trustees' approval or ratification of each such Unilateral Change Order and shall be subject to the claim provisions set forth in Article 16.11.

9.7. Construction Change Directive. A Construction Change Directive is a written instrument issued by the District directing a Change to the Work prior to the Prime Contractor and District reaching full agreement on an adjustment of the Contract Time and/or Contract Price on account of such Change. The Prime Contractor shall promptly commence and diligently complete any Change to the Work subject to a Construction Change Directive issued hereunder. The Prime Contractor shall not be relieved or excused from its prompt commencement and diligent completion of any Change subject to a Construction Change Directive by virtue of the absence or inability of the Prime Contractor and the District to agree upon the extent of any adjustment to the Contract Time or the Contract Price for such Change. The issuance of a Change Order pursuant to this Article 9 in connection with any Change authorized by the District under this Article 9.1 shall not be deemed a

condition precedent to Prime Contractor's obligation to promptly commence and diligently complete any such Change authorized by a Construction Change Directive hereunder. Upon completion of the Work such Change, if the Prime Contractor and District have not agreed on the Contract Time and Contract Price for such Change, District shall issue a Unilateral Change Order pursuant to Article 9.6 hereof.

9.8. Prime Contractor Notice of Changes. If the Prime Contractor should claim that an instruction, request, the Drawings, the Specifications, action, condition, omission, default, or other situation obligates the District to increase the Contract Price or to extend the Contract Time, the Prime Contractor shall notify the District's Inspector and the Engineer, in writing, of such claim within ten (10) days from the date of its actual or constructive notice of the factual basis supporting the same. The District shall consider any such claim of the Prime Contractor only if sufficient supporting documentation is submitted with the Prime Contractor's notice to the District's Inspector and the Engineer. Time is of the essence in Prime Contractor's written notice pursuant to the preceding sentence so that the District can promptly investigate and consider alternative measures to the address such instruction, request, Drawings, Specifications, action, condition, omission, default or other situation. Accordingly, Prime Contractor acknowledges that its failure, for any reason, to give written notice (with sufficient supporting documentation to permit the District's review and evaluation) within ten (10) days of its actual or constructive knowledge of any instruction, request, Drawings, Specifications, action, condition, omission, default or other situation for which the Prime Contractor believes there should an adjustment of the Contract Time or the Contract Price shall be deemed Prime Contractor's waiver, release, discharge and relinquishment of any right to assert or claim any entitlement to an adjustment of the Contract Time or the Contract Price on account of any such instruction, request, Drawings, Specifications, action, condition, omission, default or other situation. In the event that the District determines that the Contract Price or the Contract Time are subject to adjustment based upon the events, circumstances and supporting documentation submitted with the Prime Contractor's written notice under this Article 9.6, any such adjustment shall be determined in accordance with the provisions of Articles 9.4.1 and 9.4.2.

9.9. Disputed Changes. In the event of any dispute or disagreement between the Prime Contractor and the District or the Engineer regarding the characterization of any item as a Change to the Work or as to the appropriate adjustment of the Contract Price or the Contract Time on account thereof, the Prime Contractor shall promptly proceed with the performance of such item of the Work, subject to a subsequent resolution of such dispute or disagreement in accordance with the terms of the Contract Documents. The Prime Contractor's failure or refusal to so proceed with such Work may be deemed to be Prime Contractor's default of a material obligation of the Prime Contractor under the Contract Documents.

9.10. Emergencies. In an emergency affecting the safety of life, or of the Work, or of property, the Prime Contractor, without special instruction or prior authorization from the District or the Engineer, is permitted to act at its discretion to prevent such threatened loss or injury. Any compensation claimed by the Prime Contractor on account of such emergency work shall be submitted and determined in accordance with this Article 9.

9.11. Minor Changes in the Work. The Engineer may order minor Changes in the Work not involving an adjustment in the Contract Price or the Contract Time and not inconsistent with the intent of the Contract Documents. Such Changes shall be effected by written order and shall be binding on the District and the Prime Contractor. The Project Manager or the District's Inspector may direct the Prime Contractor to perform Changes provided that each such Change does not result in an increase of more than Five Hundred Dollars ($500) to the Contract Price and no adjustment of the Contract Time. The Prime Contractor shall carry out such orders promptly.

9.12. Unauthorized Changes. Any Work beyond the lines and grades shown on the Contract Documents, or any extra Work performed or provided by the Prime Contractor without notice to the Engineer and the District's Inspector in the manner and within the time set forth in Articles 9.2 or 9.6 shall be considered unauthorized and at the sole expense of the Prime Contractor. Work so done will not be measured or paid for, no extension to the Contract Time will be granted on account thereof and any such Work may be ordered removed at the Prime Contractor's sole cost and expense. The failure of the District to direct or order removal of such Work shall not constitute acceptance or approval of such Work nor relieve the Prime Contractor from any liability on account thereof.

ARTICLE 10: SEPARATE CONTRACTORS

10.1. District's Right to Award Separate Contracts. The District reserves the right to perform construction or operations related to the Project with the District's own forces or to award separate contracts in connection with other portions of the Project or other construction or operations at or about the Site. If the Prime Contractor claims that delay or additional cost is involved because of such action by the District, the Prime Contractor shall seek an adjustment to the Contract Price or the Contract Time as provided for in the Contract Documents. Failure of the Prime Contractor to request such an adjustment of the Contract Time or the Contract Price in strict conformity with the provisions of the Contract Documents applicable thereto shall be deemed a waiver of the same.

10.2. District's Coordination of Separate Contractors. The District shall provide for coordination of the activities of the District's own forces and of each separate contractor with the Work of the Prime Contractor, and with that of other Prime Contractors who shall cooperate with them. Each Prime Contractor shall participate with other separate contractors and the District in reviewing their respective Construction Schedules when directed to do so. The Prime Contractor shall make any revisions to the Approved Construction Schedule for the Work hereunder deemed necessary after a joint review and mutual agreement. The Construction Schedules shall then constitute the Construction Schedules to be used by the Prime Contractor, separate contractors and the District until subsequently revised.

10.3. Mutual Responsibility. The Prime Contractor shall afford the District and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities at the site of the Work and shall connect and coordinate the Contractor's Work, construction and operations with theirs as required by the Contract Documents.

10.4. Discrepancies or Defects. If part of the Prime Contractor's Work depends for proper execution or results upon construction or operations by the District or a separate Prime Contractor, the Prime

Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Engineer and the District's Inspector any apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Prime Contractor to so report shall constitute an acknowledgment that the District's or separate Prime Contractor's completed or partially completed construction is fit and proper to receive the Prime Contractor's Work, except as to defects not then discoverable by the Prime Contractor's reasonable diligence.

ARTICLE 11: TESTS AND INSPECTIONS

11.1. Tests; Inspections; Observations.

11.1.1. Prime Contractor's Notice. If the Contract Documents, laws, ordinances or any public authority with jurisdiction over the Work requires the Work, or any portion thereof, to be specially tested, inspected or approved, the Prime Contractor shall give the Engineer, the Project Manager and the District's Inspector written notice of the readiness of such Work for observation, testing or inspection at least two (2) working days prior to the time for the conducting of such test, inspection or observation. If inspection, testing or observation is by authority other than the District, the Prime Contractor shall inform the District's Inspector and the Project Manager not less than two (2) working days prior to the date fixed for such inspection, test or observation. The Prime Contractor shall not cover up any portion of the Work subject to tests, inspections or observations prior to the completion and satisfaction of the requirements of such test, inspection or observation. In the event that any portion of the Work subject to tests, inspection or approval shall be covered up by Prime Contractor prior to completion and satisfaction of the requirements of such tests, inspection or approval, Prime Contractor shall be responsible for the uncovering of such portion of the Work as is necessary for performing such tests, inspection or approval without adjustment of the Contract Price or the Contract Time on account thereof.

11.1.2. Cost of Tests and Inspections. Except as set forth below, the District will pay for fees, costs and expenses to complete the initial tests/inspections of portions of the Work as required by law, code or regulation, provided that such tests/inspections are conducted and completed at a location within a one hundred (100) mile radius of the Site. The foregoing notwithstanding, if the portion(s) of the Work subject to tests/inspections is/are not ready for such test/inspection at the time indicated in the Contractor's notice under Article 11.1.1 or if upon completion of such test/inspection, the portion(s) of the Work subject to such test/inspection do not meet or exceed the minimum requirements of such test/inspection, the Contractor shall be solely responsible for the payment of all fees, costs or expenses arising out of or related in any manner to subsequent tests/inspections of such portion(s) of the Work. Notwithstanding the District's payment of fees, costs or expenses for conducting initial tests/inspections, if any actions or failures to act of the Contractor or person or entity providing or

performing Work under the direction or control of the Contractor require tests/inspections to be conducted over a period of more than eight (8) hours per day by any single person or on weekends/holidays, the Contractor shall be solely responsible for the payment of fees, costs or expenses which result from test/inspection services which exceed eight (8) hours per day by any single person or on Weekends/holidays. If any tests/inspections are conducted outside a one hundred (100) mile radius of the Site, the Contractor shall be solely responsible for all costs, fees or expenses to conduct and complete such tests/inspections conducted at such location including, without limitation, costs to complete such tests/inspections and travel, meal and related expenses.

11.1.3. Testing/Inspection Laboratory. The District shall select duly qualified person(s) or testing laboratory(ies) to conduct the tests and inspections to be paid for by the District and required by the Contract Documents. All such tests and inspections shall be in conformity with Title 24 of the California Code of Regulations. Where inspection or testing is to be conducted by an independent laboratory or testing agency, materials or samples thereof shall be selected by the laboratory, testing agency, the District's Inspector, the Project Manager or the Engineer and not by the Prime Contractor.

11.2. Additional Tests, Inspections and Approvals. If the Engineer, the Project Manager, the District's Inspector or public authorities having jurisdiction over the Work determine that portions of the Work require additional testing, inspection or approval, the Engineer will, upon written authorization from the District, instruct the Prime Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the District, and the Prime Contractor shall give timely notice to the Engineer, the Project Manager and the District's Inspector of when and where tests and inspections are to be made so the District's Inspector and the Engineer may observe such procedures. The District shall bear the costs of such additional tests, inspections or approvals, except to the extent that such additional tests, inspections or approvals reveal any failure of the Work to comply with the requirements of the Contract Documents, in which case the Prime Contractor shall bear all costs made necessary by such failures, including without limitation, the costs of corrections, repeat tests, inspections or approvals and the costs of the Engineer's services or its consultants in connection therewith.

11.3. Delivery of Certificates. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Prime Contractor and promptly delivered to the Engineer.

11.4. Timeliness of Tests, Inspections and Approvals. Tests or inspections required and conducted pursuant to the Contract Documents shall be made or arranged by Prime Contractor to avoid delay in the progress of the Work.

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.1. Inspection of the Work.

12.1.1. Access to the Work. All Work done and all materials and equipment forming a part of the Work or incorporated into the Work are subject to inspection by the District, the Project Manager, the Engineer and the District's Inspector for conformity with the Contract Documents. The Prime Contractor shall, at its cost and without adjustment to the Contract Price or the Contract Time, furnish any facilities necessary for sufficient and safe access to the Work for purposes of inspection by the District, the Project Manager, the Engineer, the District's Inspector, DSA or any other public or quasi-public authority with jurisdiction over the Work or any portion thereof.

12.1.2. Limitations upon Inspections. Inspections, tests, measurements, or other acts of the Engineer and the District's Inspector hereunder are for the sole purpose of assisting them in determining that the Work, materials, equipment, progress of the Work, and quantities generally comply and conform to the requirements of the Contract Documents. These acts or functions shall not relieve the Prime Contractor from performing the Work in full compliance with the Contract Documents. No inspection by the Engineer or the District's Inspector shall constitute or imply acceptance of Work inspected. Inspection of the Work hereunder is in addition to, and not in lieu of, any other testing, inspections or approvals of the Work required under the Contract Documents.

12.2. Uncovering of Work. If any portion of the Work is covered contrary to the request of the Engineer, the District's Inspector or the requirements of the Contract Documents, it must, if required by the Engineer or the District's Inspector, be uncovered for observation by the Engineer and the District's Inspector and be replaced at the Prime Contractor's expense without adjustment of the Contract Time or the Contract Price.

12.3. Rejection of Work. Prior to the District's Final Acceptance of the Work, any Work or materials or equipment forming a part of the Work or incorporated into the Work which is defective or not in conformity with the Contract Documents may be rejected by the District, the Project Manager the Engineer or the District's Inspector and the Prime Contractor shall correct such rejected Work without any adjustment to the Contract Price or the Contract Time, even if the Work, materials or equipment have been previously inspected by the Engineer or the District's Inspector or even if they failed to observe the defective or nonconforming Work, materials or equipment.

12.4. Correction of Work. The Prime Contractor shall promptly correct any portion of the Work rejected by the District, the Project Manager, the Engineer or the District's Inspector for failing to conform to the requirements of the Contract Documents, or which is determined by them to be defective, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Prime Contractor shall bear all costs of correcting such rejected Work, including additional testing and inspections and compensation for the Engineer's services and

expenses made necessary thereby. The Prime Contractor shall bear all costs of correcting destroyed or damaged construction, whether completed or partially completed, of the District or separate contractors, caused by the Prime Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents, or which is defective.

12.5. Removal of Non-Conforming or Defective Work. The Prime Contractor shall, at its sole cost and expense, remove from the site all portions of the Work which are defective or are not in accordance with the requirements of the Contract Documents which are neither corrected by the Prime Contractor nor accepted by the District.

12.6. Failure of Prime Contractor to Correct Work. If the Prime Contractor fails to commence to correct defective or non-conforming Work within 3 days of notice of such condition and promptly thereafter complete the same within a reasonable time, the District may correct it in accordance with the Contract Documents. If the Prime Contractor does not proceed with correction of such defective or non-conforming Work within the time fixed herein, the District may remove it and store the salvable materials or equipment at the Prime Contractor's expense. If the Prime Contractor does not pay costs of such removal and storage after written notice, the District may sell such materials or equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Prime Contractor, including without limitation compensation for the Engineer's services, attorney's fees and other expenses made necessary thereby. If such proceeds of sale do not cover costs which the Prime Contractor should have borne, the Contract Price shall be reduced by the deficiency. If payments of the Contract Price then or thereafter due the Prime Contractor are not sufficient to cover such amount, the Prime Contractor and the Surety shall promptly pay the difference to the District.

12.7. Acceptance of Defective or Non-Conforming Work. The District may, in its sole and exclusive discretion, elect to accept Work which is defective or which is not in accordance with the requirements of the Contract Documents, instead of requiring its removal and correction, in which case the Contract Price shall be reduced as appropriate and equitable.

ARTICLE 13: WARRANTIES

13.1. Workmanship and Materials. The Prime Contractor warrants to the District that all materials and equipment furnished under the Contract Documents shall be new, of good quality and of the most suitable grade and quality for the purpose intended, unless otherwise specified in the Contract Documents. All Work shall be of good quality, free from faults and defects and in conformity with the requirements of the Contract Documents. If required by the Engineer or the District, the Prime Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment incorporated into the Work. Any Work or portion thereof no conforming to these requirements, including substitutions or alternatives not properly approved in accordance with the Contract Documents may be deemed defective. Where there is an approved substitution of, or alternative to, material or equipment specified in the Contract Documents, the Prime Contractor warrants to the District that such installation, construction, material, or equipment will equally perform the function and have the quality of the originally specified material or equipment. The Prime Contractor expressly warrants the merchantability, the fitness for use, and quality of all substitute or alternative

items in addition to any warranty given by the manufacturer or supplier of such item.

13.2. Warranty Work. If, within one year after the date of Final Acceptance, any of the Work is found to be defective or not in accordance with the requirements of the Contract Documents, or otherwise contrary to the warranties contained in the Contract Documents, the Prime Contractor shall commence all necessary corrective action not more than seven (7) days after receipt of a written notice from the District to do so, and to thereafter diligently complete the same. In the event that Prime Contractor shall fail or refuse to commence correction of any such item within said seven (7) day period or to diligently prosecute such corrective actions to completion, the District may, without further notice to Prime Contractor, cause such corrective Work to be performed and completed. In such event, Prime Contractor and Prime Contractor's Performance Bond Surety shall be responsible for all costs in connection with such corrective Work, including without limitation, general administrative overhead costs of the District in securing and overseeing such corrective Work. Nothing contained herein shall be construed to establish a period of limitation with respect to any obligation of the Prime Contractor under the Contract Documents. The obligations of the Prime Contractor hereunder shall be in addition to, and not in lieu of, any other obligations imposed by any special guarantee or warranty required by the Contract Documents, guarantees or warranties provided by any manufacturer of any item or equipment forming a part of, or incorporated into the Work, or otherwise recognized, prescribed or imposed by law. Neither the District's Final Acceptance, the making of Final Payment, any provision in Contract Documents, nor the use or occupancy of the Work, in whole or in part, by District shall constitute acceptance of Work not in accordance with the Contract Documents nor relieve the Prime Contractor or the Prime Contractor's Performance Bond Surety from liability with respect to any warranties or responsibility for faulty or defective Work or materials, equipment and workmanship incorporated therein.

13.3. Guarantee. Upon completion of the Work, Prime Contractor shall execute and deliver to the District the form of Guarantee included within the Contract Documents. Pursuant to Article 8.4.2 above, Prime Contractor's execution and delivery of the form of Guarantee is an express condition precedent to any obligation of the District to disburse the Final Payment to the Prime Contractor.

13.4. Survival of Warranties; Surety Obligations. The provisions of this Article 13 shall survive the Prime Contractor's completion of Work under the Contract Documents, the District's Final Acceptance or the termination of the Contract. The obligations of the Performance Bond Surety shall include, without limitation, assumption, performance, discharge and satisfaction of the Prime Contractor obligations under this Article 13 in the event of the failure or refusal of the Prime Contractor to assume, perform, discharge and satisfaction the obligations of the Prime Contractor set forth in this Article 13.

ARTICLE 14: SUSPENSION OF WORK

14.1. District's Right to Suspend Work. The District may, without cause, and without invalidating or terminating the Contract, order the Prime Contractor, in writing, to suspend, delay or interrupt the Work in whole or in part for such period of time as the District may determine. The Prime Contractor shall resume and complete the Work suspended by the District in accordance with the District's directive, whether issued at the time of the directive suspending the Work or subsequent

thereto.

14.2. Adjustments to Contract Price and Contract Time. In the event the District shall order suspension of the Work, an adjustment shall be made to the Contract Price for increases in the direct cost of performance of the Work of the Contract Documents, actually caused by suspension, delay or interruption ordered by the District; provided however that no adjustment of the Contract Price sba1l be made to the extent: (i) that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Prime Contractor is responsible under the Contract Documents; or (ii) that an equitable adjustment is made or denied under another provision of the Contract Documents. The foregoing notwithstanding, any such adjustment of the Contract Price shall not include any adjustment to increase the Prime Contractor's overhead, general administrative costs or profit, all of which will remain as reflected in the Cost Breakdown submitted by the Prime Contractor pursuant to the Contract Documents. In the event of the District's suspension of the Work, the Contract Time shall be equitably adjusted.

ARTICLE 15: TERMINATION

15.1. Termination for Cause.

15.1.1. District's Right to Terminate. The District may terminate the Contract upon the occurrence of anyone or more of the following events of the Prime Contractor's default: (i) if the Prime Contractor refuses or fails to prosecute the Work with diligence as will insure Substantial Completion of the Work within the Contract Time, or if the Prime Contractor fails to substantially Complete the Work within the Contract Time; (ii) if the Prime Contractor becomes bankrupt or insolvent, or makes a general assignment for the benefit of creditors, or if the Prime Contractor or a third party files a petition to reorganize or for protection under any bankruptcy or similar laws, or if a trustee or receiver is appointed for the Prime Contractor or for any of the Prime Contractor's property on account of the Prime Contractor's insolvency, and the Prime Contractor or its successor in interest does not provide adequate assurance of future performance in accordance with the Contract Documents within 10 days of receipt of a request for such assurance from the District; (iii) if the Prime Contractor repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment; (iv) if the Prime Contractor repeatedly fails to make prompt payments to any Subcontractor, of any tier, or Material Suppliers or others for labor, materials or equipment; (v) if the Prime Contractor disregards laws, ordinances, rules, codes, regulations, orders applicable to the Work or similar requirements of any public entity having jurisdiction over the Work; (iv) if the Prime Contractor disregards proper directives of the Engineer, the District's Inspector or District under the Contract Documents; (vii) if the Prime Contractor performs Work which deviates from the Contract Documents and neglects or refuses to correct such Work; or (viii) if the Prime Contractor otherwise violates in any material way any provisions or requirements of the Contract Documents. Once the District determines that sufficient cause exists to justify the action, the District may terminate the Contract without prejudice to any other right or remedy the District may have, after giving

the Prime Contractor and the Surety at least seven (7) days advance written notice of the effective date of termination. The District shall have the sole discretion to permit the Prime Contractor to remedy the cause for the termination without waiving the District's right to terminate the Contract, or otherwise waiving, restricting or limiting any other right or remedy of the District under the Contract Documents or at law.

15.1.2. District's Rights upon Termination. In the event that the Contract is terminated pursuant to this Article 15.1, the District may take over the Work and prosecute it to completion, by contract or otherwise, and may exclude the Prime Contractor from the site. The District may take possession of the Work and of all of the Prime Contractor's tools, appliances, construction equipment, machinery, materials, and plant which may be on the site of the Work, and use the same to the full extent they could be used by the Prime Contractor without liability to the Prime Contractor. In exercising the District's right to prosecute the completion of the Work, the District may also take possession of all materials and equipment stored at the site of the Work or for which the District has paid the Prime Contractor but which are stored elsewhere, and finish the Work as the District deems expedient. In exercising the District's right to prosecute the completion of the Work, the District shall have the right to exercise its sole discretion as to the manner, methods, and reasonableness of the costs of completing the Work and the District shall not be required to obtain the lowest figure for completion of the Work. In the event that the District takes bids for remedial Work or completion of the Work, the Prime Contractor shall not be eligible for the award of such contract(s).

15.1.3. Completion by the Surety. In the event that the Contract is terminated pursuant to this Article 15.1, the District may demand that the Surety take over and complete the Work. The District may require that in so doing, the Surety not utilize the Prime Contractor in performing and completing the Work. Upon the failure or refusal of the Surety to take over and begin completion of the Work within twenty (20) days after demand therefore, the District may take over the Work and prosecute it to completion as provided for above.

15.1.4. Assignment and Assumption of Subcontracts. The District shall, in its sole and exclusive discretion, have the option of requiring any Subcontractor or Material Supplier to perform in accordance with its Subcontract or Purchase Order with the Prime Contractor and assign the Subcontract or Purchase Order to the District or such other person or entity selected by the District to complete the Work.

15.1.5. Costs of Completion. In the event of termination under this Article 15.1, the Prime Contractor shall not be entitled to receive any further payment of the Contract Price until the Work is completed. If the unpaid balance of the Contract Price as of the date of termination exceeds the District's direct and indirect costs and expenses for completing the Work, including without limitation, attorneys' fees and compensation for additional professional and consultant services, such excess shall be used to pay the Prime Contractor for the cost of the Work

performed prior to the effective date of termination with a reasonable allowance for overhead and profit. If the District's costs and expenses to complete the Work exceed the unpaid Contract Price, the Prime Contractor and/or the Surety shall pay the difference to the District.

15.1.6. Prime Contractor Responsibility for Damages. The Prime Contractor and the Surety shall be liable for all damage sustained by the District resulting from, in any manner, the termination of Contract under this Article 15.1, including without limitation, attorneys' fees, and for all costs necessary for repair and completion of the Work over and beyond the Contract Price.

15.1.7. Conversion to Termination for Convenience. In the event the Contract is terminated under this Article 15.1, and it is determined, for any reason, that the Prime Contractor was not in default under the provisions hereof, the termination shall be deemed a Termination for Convenience of the District and thereupon, the rights and obligations of the District and the Prime Contractor sha11 be determined in accordance with Article 15.2 hereof.

15.1.8. District's Rights Cumulative. In the event the Contract is terminated pursuant to this Article 15.1, the termination sha11 not affect or limit any rights or remedies of the District against the Prime Contractor or the Surety. The rights and remedies of the District under this Article 15.1 are in addition to, and not in lieu of, any other rights and remedies provided by law or otherwise under the Contract Documents. Any retention or payment of monies to the Prime Contractor by the District shall not be deemed to release the Prime Contractor or the Surety from any liability hereunder.

15.2. Termination for Convenience of the District. The District may at any time, in its sole and exclusive discretion, by written notice to the Prime Contractor, terminate the Contract in whole or in part when it is in the interest of, or for the convenience of, the District. In such case, the Prime Contractor shall be entitled to payment for: (i) Work actually performed and in place as of the effective date of such termination for convenience of the District, with a reasonable allowance for profit and overhead on such Work, and (ii) reasonable termination expenses for reasonable protection of Work in place and suitable storage and protection of materials and equipment delivered to the site of the Work but not yet incorporated into the Work, provided that such payments exclusive of termination expenses sha11 not exceed the total Contract Price as reduced by payments previously made to the Prime Contractor and as further reduced by the value of the Work as not yet completed. The Prime Contractor shall not be entitled to profit and overhead on Work which was not performed as of the effective date of the termination for convenience of the District. The District may, in its sole and exclusive discretion, elect to have assigned to the District any Subcontract or Purchase Order to which the Prime Contractor is a party and thereupon requiring any Subcontractor or Material Supplier to performance in accordance with the Subcontract or Purchase Order between such Subcontractor or Material Supplier and the Prime Contractor. If the District elects to effectuate such assignment of any such Subcontract or Purchase Order, such assignment shall be effective in accordance with the District's written notice to the Prime Contractor and any Subcontractor or Material Supplier of the District's election to have such Subcontract or

Purchase Order assigned to the District.

ARTICLE 16: MISCELLANEOUS

16.1. Governing Law. This Contract shall be governed by and interpreted in accordance with the laws of the State of California.

16.2. Marginal Headings; Interpretation. The titles of the various Articles of these General Conditions and elsewhere in the Contract Documents are used for convenience of reference only and are not intended to, and shall in no way, enlarge or diminish the rights or obligations of the District or the Prime Contractor and shall have no effect upon the construction or interpretation of the Contract Documents. The Contract Documents shall be construed as a whole in accordance with their fair meaning and not strictly for or against the District or the Prime Contractor.

16.3. Successors and Assigns. Except as otherwise expressly provided in the Contract Documents, all terms, conditions and covenants of the Contract Documents sha11 be binding upon, and shall inure to the benefit of the District and the Prime Contractor and their respective heirs, representatives, successors-in-interest and assigns.

16.4. Cumulative Rights and Remedies; No Waiver. Duties and obligations imposed by the Contract Documents and rights and remedies available there under shall be in addition to and not in lieu of or otherwise a limitation or restriction of duties, obligations, rights, and remedies otherwise imposed or available by law. No action or failure to act by the District sha11 constitute a waiver of a right or remedy afforded it under the Contract Documents or at law nor shall such an action or failure to act constitute approval of or acquiescence in a breach hereunder, except as may be specifically agreed in writing.

16.5. Severability. In the event any provision of the Contract Documents shall be deemed illegal, invalid, unenforceable and/or void, by a court or any other governmental agency of competent jurisdiction, such provision shall be deemed to be severed and deleted from the Contract Documents, but all remaining provisions hereof, shall in all other respects, continue in full force and effect.

16.6. No Assignment by Prime Contractor. The Prime Contractor shall not sublet or assign the Contract, or any portion thereof, or any monies due there under, without the express prior written consent and approval of the District, which approval may be withheld in the sole and exclusive discretion of the District. The District's approval to such assignment shall be upon such terms and conditions as determined by the District in its sole and exclusive discretion.

16.7. Gender and Number. Whenever the context of the Contract Documents so require, the neuter gender shall include the feminine and masculine, the masculine gender shall include the feminine and neuter, the singular number shall include the plural and the plural number shall include the singular.

16.8. Independent Prime Contractor Status. In performing its obligations under the Contract Documents, the Prime Contractor shall be deemed an independent contractor to the District and not an agent or employee of the District.

16.9. Notices. Except as otherwise expressly provided for in the Contract Documents, all notices which the District or the Prime Contractor may be required, or may desire, to serve on the other, shall be effective only if delivered by personal delivery or by postage prepaid, First Class Certified Return Receipt Requested United States Mail, addressed to the District or the Prime Contractor at their respective address set forth in the Contract Documents, or such other address(es) as either the District or the Prime Contractor may designate from time to time by written notice to the other in conformity with the provisions hereof. In the event of personal delivery, such notices shall be deemed effective upon delivery, provided that such personal delivery requires a signed receipt by the recipient acknowledging delivery of the same. In the event of mailed notices, such notice shall be deemed effective on the third working day after deposit in the mail.

16.10. Disputes; Continuation of Work. Notwithstanding any claim, dispute or other disagreement between the District and the Prime Contractor regarding performance under the Contract Documents, the scope of Work there under, or any other matter arising out of or related to, in any manner, the Contract Documents, the Work or the Project, the Prime Contractor shall proceed diligently with performance of the Work and its other obligations under the Contractor Documents in accordance with the District's written direction, pending any final determination or decision regarding any such claim, dispute or disagreement.

16.11. Dispute Resolution; Arbitration.

16.11.1. Claims Under $375,000.00. Claims between the District and the Contractor of $375,000.00 or less sha1l be resolved in accordance with the procedures established in Part 3, Chapter 1, Article 1.5 of the California Public Contract Code, §§20104 et seq.; provided however that California Public Contract Code §20104.2(a) shall not supersede the requirements of the Contract Documents with respect to the Contractor's notification to the District of such claim or extend the time for the giving of such notice as provided in the Contract Documents. The term "claims" as used herein shall be as defined in California Public Contract Code §20104(b) (2).

16.11.2. Arbitration. Except as provided in Article 16.11.1, any other claims, disputes, disagreements or other matters in controversy between the District and the Contractor arising out of, or related, in any manner, to the Contract Documents, or the interpretation, clarification or enforcement thereof shall be resolved by arbitration conducted by a JAMS arbitrator identified as having expertise in Construction and in accordance with the Comprehensive Arbitration Rules and Procedures of JAMS in effect as of the date that a Demand for Arbitration is filed, except as expressly modified herein. The locale for any arbitration commenced hereunder shall be the regional office of JAMS closest to the Site.

16.11.3. Government Code Claims. Pursuant to Government Code Section 930.6, any and all claims, demands, disputes, disagreements or other matters in controversy between the Contractor and the District for money or damages, including, without limitation, a demand for arbitration, sha1l be deemed a "suit for money or damages" and shall be subject to the provisions of Government Code Sections 945.4, 945.6 and 946. Notwithstanding the dispute resolution and arbitration provisions set forth in Article 16 herein, all claims demands, disputes, disagreements or other matters in controversy between the Contractor and the District seeking money or damages in any sum shall first be presented to the District's Board of Trustees and acted upon or deemed rejected as a condition precedent to suit including, without limitation, demand for arbitration, in accordance with California Government Code section 900, et seq.

16.11.4. Not Used.

16.11.5. Demand for Arbitration. A Demand for Arbitration shall be filed and served within a reasonable time after the occurrence of the claim, dispute or other disagreement giving rise to the Demand for Arbitration, but in no event shall a Demand for Arbitration be filed or served after the date when the institution of legal or equitable proceedings based upon such claim, dispute or other disagreement would be barred by the California Government Code or applicable statute of limitations. In the event more than one Demand for Arbitration is made by either the District or the Contractor, all such controversies shall be consolidated into a single arbitration proceeding, unless otherwise agreed to by the District and the Contractor.

16.11.6. Third Parties. The Contractor's Surety, a Subcontractor or Material Supplier to the Contractor and other third parties may be permitted to join in and be bound by an arbitration commenced hereunder if required by the terms of their respective agreements with the Contractor, except to the extent that such joinder would unduly delay or complicate the expeditious resolution of the claim, dispute or other disagreement between the District and the Contractor, in which case an appropriate severance order shall be issued by the arbitrator.

16.11.7. Discovery. In connection with any arbitration proceeding commenced hereunder, the discovery rights and procedures provided for in California Code of Civil Procedure § 1283.05 shall be applicable, and the same shall be deemed incorporated herein by this reference.

16.11.8. Arbitrator's Award. Notwithstanding Rule 24 of JAMS Comprehensive Arbitration Rules and Procedures, in accordance with California Code of Civil Procedure § 1296, in any arbitration to resolve a dispute relating to the Contract Documents, the arbitrator's award shall be supported by law and substantial evidence; the District and Contractor hereby expressly agree that a court shall, subject to California Code of Civil Procedure §1286.4, vacate the award if after

review of the award it determines either that the award is not supported by substantial evidence or that it is based on an error of law. Any arbitration award that does not include written findings of fact and conclusions of law in conformity with California Code of Civil Procedure §1296 shall be invalid and unenforceable. Subject to the foregoing provisions of this Article 16.11, the arbitrator's award shall be final and binding upon the District and the Contractor.

16.11.9. Costs. The expenses and fees of the arbitrator shall be divided equally among the parties to the arbitration. Each party to any arbitration commenced hereunder shall be responsible for and shall bear its own attorneys' fees, witness fees and other cost and expense incurred in connection with such arbitration. The foregoing notwithstanding, the arbitrator may award arbitration costs, including arbitrators' fees but excluding attorneys' fees, to the prevailing party.

16.11.10. Confirmation of Award. The confirmation, enforcement, vacation or correction of an arbitration award rendered hereunder shall be the Superior Court of the State of California for the county in which the Site is situated. The substantive and procedural rules for such post-award proceedings shall be as set forth in California Code of Civil Procedure §1285 et seq.

16.11.11. Not Used.

16.11.12. Limitation on Damages. In the event of the District's breach or default of its obligations under the Agreement, the damages, if any, recoverable by the Contractor shall be limited to general damages which are directly caused by the breach or default of the District and shall exclude any and all special or consequential damages, if any. By executing the Agreement, the Contractor expressly acknowledges the foregoing limitation to recovery of only general damages from the District if the District is in breach or default of its obligations under the Agreement; the Contractor expressly waives and relinquishes any recovery of special or consequential damages from the District including, without limitation, damages for: i) lost or impaired bonding capacity; and/or, ii) lost profits arising out of or in connection with any past, present, or future work of improvement, except for the Project which is the subject of the Contract Documents.

16.11.13. Inapplicability to Bid Bond. The provisions of this Article 16.11 shall not be applicable to disputes, disagreements or enforcement of rights or obligations under the Bid Bond; all claims, disputes, and actions to enforce rights or obligations under the Bid Bond shall be adjudicated only by judicial proceedings commenced in a court of competent jurisdiction.

16.12. Capitalized Terms. Except as otherwise expressly provided, capitalized terms used in the Contract Documents shall have the meaning and definition for such terms as set forth in the Contract Documents.

16.13. Attorney's Fees. Except as expressly provided for in the Contract Documents, or authorized by law, neither the District nor the Prime Contractor shall recover from the other any attorneys' fees or other costs associated with or arising out of any legal, administrative or other proceedings filed or instituted in connection with or arising out of the Contract Documents or the performance of either the District or the Prime Contractor thereunder.

16.14. Provisions Required by Law Deemed Inserted. Each and every provision of law and clause required by law to be inserted in the Contract Documents shall be deemed to be inserted herein and the Contract Documents shall be read and enforced as though such provision or clause are included herein, and if through mistake, or otherwise, any such provision or clause is not inserted or if not correctly inserted, then upon application of either party, the Contract Documents shall forthwith be physically amended to make such insertion or correction.

16.15. Days. Unless otherwise stated, references to "days" in the Contract Documents shall be deemed to be calendar days.

16.16. Entire Agreement. The Contract Documents contain the entire agreement and understanding between the District and the Prime Contractor concerning the subject matter hereof, and supersedes and replaces all prior negotiations, proposed agreements or amendments, whether written or oral. No amendment or modification to any provision of the Contract Documents shall be effective or enforceable except by an agreement in writing executed by the District and the Prime Contractor.

[END OF SECTION]

SPECIAL CONDITIONS

1. Application of Special Conditions. These Special Conditions for a part of the Contract Documents for the Work generally described as: **COS Student Union Project, Bid Package.**

2. Drawings and Specifications. The number of sets of the Drawings and Specifications which the District will provide to the Contractor, pursuant to Article 2.1.3 of the General Conditions is one (1) electronic (PDF) copy, upon request. Additional sets of the Drawings and Specifications may be obtained by the Contractor from the District at the cost of reproduction.

3. Contacts. College of the Sequoias - District Police emergency phone (24 hours/7 days a week): (559) 730-3999.

4. Insurance.

4.1. Insurance Requirements for Contractor and Subcontractors. Pursuant to Article 6 of the General Conditions, the Contractor and each Subcontractor shall obtain and maintain the following insurance coverage with the following minimum coverage amounts:

Workers Compensation Insurance:	(In accordance with applicable law)
Employers Liability Insurance:	$1,000,000
Commercial General Liability Insurance	
(Coverage including bodily injury, death, property damage, motor vehicle liability)	
Per Occurrence:	$1,000,000
Aggregate:	$2,000,000

4.2. Builders Risk Insurance. In accordance with Article 6.3 of the General Conditions, coverage shall be provided by the Contractor for the full insurable value of the Work. Coverage for the perils of earthquakes will not be included within the scope of coverage under the Builders Risk Insurance Policy.

5. Contract Time for Final Completion of Bid Package. The District intends to construct the Work using a "General Contractor" approach. The Contractor awarded the Contract for the Bid Package must complete the Work of the Bid Package in coordination with the Contractor and its Subcontractors awarded the contract for other portions of the Work ("the General Construction Bid Package"); coordination of the Work of the Bid Package and the work of the General Construction Bid Package will be through the District. The Work of the Bid Package is described elsewhere in the Contract Documents. The Commencement Date for the Work of the Bid Package shall be the date set forth in the Notice to Proceed issued by or on behalf of the District. The Contractor awarded the Bid Package must achieve Final Completion of the Work of the Bid Package on or before the

Final Completion Date set forth herein. Failure of the Contractor awarded the Contract for the Bid Package to complete Substantial Completion within the time set forth herein will subject the Contractor to as set forth in Article 9 below.

6. Milestones.

6.1. Completion of Interim Milestones. The Contractor awarded the Bid Package must also complete the Interim Milestones indicated below, subject to modifications thereto issued in accordance with the Contract Documents. Failure of the Contractor awarded the Contract for the Bid Package to complete Interim Milestones within the time set forth below will subject the Contractor to Liquidated Damages set forth below.

6.2. Proposed Milestone Completion Schedule. In accordance with Article 7.3.3 of the General Conditions, within seven (7) days following issuance of the Notice to Proceed, the Contractor awarded the Bid Package shall prepare and submit to the District Preliminary Baseline Construction Schedules reflecting all of Contractor's proposed revisions and recommendations to the Bid Schedule while incorporating the requisite milestone completion dates set forth in these Special Conditions. Acceptance of Contractor proposed revisions and recommendations into the Baseline Construction Schedule will be done at the sole and exclusive discretion of the District. The Contractor shall notify the District, in writing, in the event that the Contractor has no proposed revisions or recommendations to the Bid Schedule. Contractor's failure to timely submit a Preliminary Baseline Construction Schedule shall be deemed as to have acquiesced and agreed to the Bid Schedule. Furthermore, Contractor's failure to timely submit a Preliminary Baseline Construction Schedule shall be deemed a waiver of Contractor's right to establish and submit a Proposed Milestone Completion Schedule. The District shall thereafter establish the milestone completion dates for that Bid Package and incorporate the Bid Schedule into the Baseline Construction Schedule.

6.3. Completion of a Milestone. Each milestone shall be deemed completed on the date the Project Inspector and/or District Representative executes the Contractor's Request for Inspection acknowledging that the Work has been satisfactorily completed in accordance the Contract Documents.

6.4. Contractor Liability for Delays. The Contractor is responsible for prosecuting the Work of its Bid Package in accordance with the then most current Baseline Construction Schedule or Updated Construction Schedule. In addition to Liquidated Damages liability, the Contractor for the Bid Package shall be liable for:

a. All costs, expenses or other charges (including direct, indirect, and/or administrative) incurred by Contractor in furnishing such materials, labor, equipment or services necessary to recover and/or maintain progress of the Work in accordance with the then current Construction Schedule; and

b. Costs, losses, expenses, damages, claims or other demands asserted by the

Contractor or its Subcontractors for the General Building Bid Package ("Other Contractors") whose progress is delayed, interrupted, hindered or otherwise impacted by the Contractor's failure to complete the Work of the Bid Package in accordance with the then most current Construction Schedule.

The obligation of the Contractor and the Contractor's Performance Bond Surety to defend, indemnify and hold harmless the Indemnified Parties, as set forth in Article 6.8 of the General Conditions, shall be deemed to include requests for equitable adjustment, claims, demands, actions, causes of actions or proceedings initiated by Other Contractors based in whole or in part on the delays of the Contractor in completing the Work of the Bid Package, or portions thereof, in accordance with the then most current Construction Schedule.

7. Liquidated Damages. Prior to bidding and as part of the Bid Package, the District will establish a master CPM schedule (the "Bid Schedule") for completion of the Work of General Contractor to meet the final completion date of the entire Project required by Owner. The Bid Schedule shall establish the following: (a) final completion date required by Owner for the Bid Package; and (b) milestone dates for the Contractor's incremental activities within the Bid Schedule, including but not limited to Submittals, Tasks and Closeout Documents. Contractor shall be liable for and shall forfeit and pay to the District as Liquidated Damages, and not as penalty the sums as set forth in Article 9, for the Contractor's failure to meet (1) the overall Bid Package completion date; and (2) the date for completing work on any Milestone of the Bid Package. The Liquidated Damages shall be assessed for the Contractor's failure to meet the above; dates are cumulative and continue until all of Work of a Milestone is completed or Final Completion of the Work is established by District and/or Owner's Architect(s)/Engineer(s).

8. Milestones. In addition to the Contractor's obligations to achieve Final Completion within the Contract Time, the Contractor shall commence/complete Milestones as described and set forth below. Failure of the Contractor to commence and complete Milestones pursuant to the following will subject the Contractor to Liquidated Damages liability to the District as set forth in these Special Conditions.

Milestone Event	**Milestone Date**
Bid Opening	10/27/2026
Owner Issues Notice of Intent to Award (Estimate)	10/30/2026
Owner Issues Notice of Award (Estimate)	11/10/2026
Start of Construction/NTP (Estimate, see phases below)	12/14/2026
End of Construction (Estimate, see phases below)	3/13/2029

Phase 1 – Construction of New Building/Site Work 670 Calendar Days

Contractor to construct new Student Union building and complete all site work along west, south, and east sides of building. New Student Union building must achieve substantial completion and permit to occupy no later than 670 calendar days after commencement of construction. Existing Alta Peak (cafeteria) building to remain occupied/operational by District at all times during Phase 1 construction. District and Contractor will determine exact limits of construction along north side of project area prior to start of Phase 1 construction.

Phase 2 – District Moves / Vacate Alta Peak 60 Calendar Days
Upon occupancy and successful operation of Student Union building, District will require a maximum of 60 days to move all equipment out of existing Alta Peak building. During this time, District will coordinate abatement of all known hazardous materials involved in the building structure. During this phase, Contractor shall not perform any work that may interfere with campus operations.

Phase 3 – Demolition of Alta Peak /New Site Work 90 Calendar Days
Upon District vacancy and completion of hazardous material abatement, District will turn the site over to the Contractor to complete the demolition of the existing Alta Peak building and all remaining work as indicated in the bid documents. New Student Union building and site work (west, south, and east sides of building) to remain occupied/operational by District at all times during Phase 3 construction.

Total Duration of Construction (Calendar Days) 820 Calendar Days

9. District Withhold of Liquidated Damages, Performance Bond Surety. If the Contractor fails to complete Milestones within the time established herein or achieve Final Completion of the Bid Package within the time established herein, the Contractor shall be subject to assessment of Liquidated Damages. The District may withhold such assessments from the Contract Price then or thereafter due the Contractor. If the assessment of Liquidated Damages exceeds the then remaining balance of the Contract Price, the Contractor and the Surety issuing the Performance Bond shall be jointly and severally liable to the District for such amounts. Liquidated Damages are as follows:

Milestone Event / Liquidated Damages
Substantial Completion of the Work:

- Liquidated Damages: Three Thousand Dollars ($3,000) per day after established Substantial Completion date.

Final Owner Acceptance:

- Liquidated Damages: Three Thousand Dollars ($3,000) per day after established Final Owner Acceptance date.

10. Progress Payment Applications. At least fifteen days before the date established for each progress payment, the Contractor shall submit to the District a Draw Request (G703) on which both District and Contractor shall agree as to the appropriate payment for work completed in accordance with the Schedule of Values. Upon agreement of Draw Request (G703), Contractor shall submit to the District Application for Certification of Payment (G702). Such application shall include approval signature from the Project Inspector and shall be notarized, if required.

11. Mark-Ups on Changes to the Work. In the event of Changes to the Work, pursuant to Article 9 of the General Conditions, the mark-up for all overhead (including home and field office overhead), general conditions costs and profit, shall not exceed the percentage of allowable direct actual costs for performance of the Change as set forth below. For the portion of any Change

performed by Subcontractors of any tier, the percentage mark-up on allowable actual direct labor and materials costs incurred by all Subcontractors of any tier shall be ten percent (10%). In addition, for the portion of any Change performed by a Subcontractor of any tier, the Contractor may add an amount equal to five percent (5%) of the allowable actual direct labor and materials costs of Subcontractors performing the Change. For the portion of any Change performed by the Contractor's own forces, the mark-up on the allowable actual direct labor and materials costs of such portion of a Change shall be fifteen percent (15%). In addition to the foregoing provisions of this Paragraph, Contractor may add a bond premium fee equal to the lesser of its actual bond premium percentage or one percent (1%) of the actual direct costs for performance of the Change.

12. Modifications to General Conditions Article 4.14. Contractor need not provide any temporary facilities for use by the Project Inspector; the District will provide temporary facilities for use by the Project Inspector.

13. Hours/Days of Work at Site. The District facilities in and about the Site will be occupied between 6:30 a.m. and 10:00 p.m. Mondays through Fridays and 6:30 a.m. and 6:00 p.m. on Saturdays. During construction, at the conclusion of each day of work, the Contractor will be allowed to section off enough working area, with Owner approved barricades, to allow access for the following day's work. No adjustment of the Contract Time or Contract Price will be permitted on account of the District's use or occupancy of the site and/or parking facilities. Construction activities shall be conducted between 6:30 a.m. and 4:30 p.m. Monday through Friday unless noted otherwise in the Contract Documents – see Project Manual (Special Conditions, Article 8. Milestones) for building accessibility details, specific permitted hours of work and Project Schedule requirements. During performance of the Work on the project, Contractor shall not interfere with the normal, regular, or existing business operations or activities of Owner at the site. No Work at the Site is permitted except during such days and hours.

14. Parking. Limited parking will be available within the perimeter of the Site without cost or charge to the Contractor, on a first-come, first-served basis. Contractors are encouraged to only bring vehicles identified with company markings inside the construction perimeter. Additional parking is available in District parking lots subject to the daily parking charges and compliance with District parking lot rules and regulations. Temporary parking permits may be obtained at the Facilities Office. District Police will ticket any vehicle without a valid parking permit located outside of the designed construction area. No adjustment of the Contract Time or the Contract Price shall be allowed on account of limited parking within the Site or for parking in the District's parking lots.

15. Discovery of Archeological Resources. If, during the Work, the Contractor encounters materials which are or may be an Archeological Resource (as that term is used and defined in California Public Resources Code §21083.2), the Contractor shall take action as set forth herein.

15.1. Contractor Responsibility. Upon encountering such materials, the Contract shall:

a. Immediately cease Work and any other activity which will or may result in disturbances of the area(s) where such materials are encountered;
b. Immediately notify the Engineer, Project Inspector and District in writing of the encountering of such materials; and

c. Take appropriate measures, including any directed or authorized by the District to cordon-off the area(s) in which such materials are encountered to prevent access to, and further disturbance of such area(s), pending determination of whether such materials are Archeological Resources and direction from the District regarding resumption of Work in such area(s).

15.2. District Investigation. Upon receipt of such written notice from the Contractor, the District shall promptly investigate and determine whether the materials encountered constitute Archeological Resource(s), and if so, whether such materials are Unique or Non-Unique Archeological Resources. Upon completing such investigation, the District shall notify the Contractor in writing of the results of such investigation, along with direction for resumption of the Work or further suspension of the Work in such area(s), pending completion of archeological mitigation measures.

15.3. Contractor Continuation of Work. If it is determined that the materials are not Archeological Resources or are Non-Unique Archeological Resources (as that term is used and defined in California Public Resources Code §21083.2(h)), the District shall notify the Contractor in writing of such conclusion. Upon receipt of such notice from the District, the Contractor shall immediately resume the Work in the area(s) where potential Archeological Resources were encountered. If it is determined that the materials are Unique Archeological Resources (as that term is used and defined in California Public Resources Code §21083.2(g), the District shall notify the Contractor in writing of such conclusion. In such event, the Contractor shall defer further Work in such area(s) pending the District's completion of archeological mitigation measures and direction or authorization from the District to resume Work in such area(s).

15.4. Adjustment of Contract Time for Encountering Actual or Potential Archeological Resources. If the Contractor encounters materials which are or may be Archeological Resources and the Work is suspended pending the District's investigation of such materials to ascertain whether or not such materials constitute Archeological Resources and the suspension of Work in such area(s) directly delays performance of activities on the Critical Path of the then current Master Project Schedule, such suspension of the Work shall be deemed an Excusable Delay (as that term is used and defined in Article 7.4.1 of the General Conditions). The Contractor shall be entitled to an adjustment of the Contract Time to the extent that the Contractor's Critical Path activities are delayed by such suspension. The Contract Price due the Contractor shall not be subject to increase or other adjustment on account of suspension of Work as a result of encountering materials which are or may be Archeological Resources.

15.5. Adjustment of Contract Time for Encountering Archeological Resources. If the Contractor encounters materials which are determined to be Unique Archeological Resources and the Work is suspended pending the District's archeological mitigation activities and the suspension of Work in such area(s) directly delays performance of activities on the Critical Path of the then current Master Project Schedule, such suspension of the Work shall be deemed an Excusable Delay (as that term is used and defined in Article 7.4.1 of the General Conditions). The Contractor shall be entitled

to an adjustment of the Contract Time to the extent that the Contractor's Critical Path activities are delayed by such suspension. The Contract Price due the Contractor shall not be subject to increase or other adjustment on account of suspension of Work as a result of encountering materials which are determined to be Unique Archeological Resources.

15.6. Adjustment of Contract Price. The extent to which, if any, the Contract Price due the Contractor is subject to adjustment as a result of encountering actual or potential Archeological Resources shall be limited as set forth herein. Adjustment of the Contract Price shall be limited to activities necessary to secure the area(s) in which actual or potential Archeological Resources are encountered from further access or disturbances. The extent of adjustment of the Contract Price shall be limited to the allowable costs and mark-ups thereon for Changes to the Work, as set forth in the Contract Documents.

15.7. Contractor Continuation of Work in Other Areas. The foregoing provisions shall not excuse nor limit, waive or modify the Contractor's obligation to diligently proceed with performance of Work in all areas of the Site unaffected by the encountering of materials which may be Archeological Resources.

16. Permits, Fees, and Approvals. Permits, fees and approvals necessary to complete the Work will be obtained and paid for by the District.

17. Standardized Forms. Each and every document generated and/or submitted by the Contractor relating to cost breakdowns, applications for payment, change order requests, requests for information, submittals, verified reports, progress reports, and all other matters relating to the administration of the Work as set forth in the General Conditions, shall be prepared by the Contractor on such forms as may be directed by the COS District. Unless otherwise expressly provided for in the Contract Documents, all such documents shall be submitted to the District with such frequency as the District may require in its sole reasonable discretion.

18. Injury and Illness Prevention Plan. Contractor shall comply with, and require its subcontractors to comply with, the Cal/OSHA Injury and Illness Prevention Plan set forth in Title 8 of the California Code of Regulations Sections 3203 and 1509, including, without limitation, conducting "toolbox" or "tailgate" safety meetings, or equivalent, with their crew at least every 10 working days to emphasize safety.

19. Safety Programs.
Article 4.9.1 of the General Conditions is modified by addition of the following:

4.9.1.1 General Safety Provisions. Contractor will develop and implement a construction safety program in accordance with District's site rules and security requirements and the Williams-Steiger Occupational Safety and Health Act of 1970 and California Code 1 Regulations, Title 8 (Cal/OSHA) as may be amended and including all regulations adapted pursuant thereto in effect at the time of delivery or performance of service. In case of conflict between the documents the Williams-Steiger Act and Cal/OSHA shall be controlling.

The Contractor will be solely responsible for all safety aspects of the work under the Contract. The Contractor will be responsible for ensuring that all its Subcontractors, of any tier are familiar with, fully trained in, and comply with all safety provisions.

The Contractor will at all times maintain a constant vigil for accidents and will prepare and submit to District's representative a written report for any accident, illness, or injury requiring outside medical attention. This report shall contain all data pertinent to the accident (time, place, description of accident, personnel involved, type of injuries, etc.) and shall be submitted within 5 working days. In lieu of a formal report the Contractor may substitute the required Cal OSHA form. Contractor will also notify College of the Sequoias District Police using (559) 730-3999 immediately after an accident, illness or injury has occurred.

At the conclusion of the project, Contractor will submit to District a statement confirming the status of any accident and a release of liability holding District and the Owner harmless against any future claims.

4.9.1.2 Contractor's General Safety Provisions, Site Rules & Security Requirements. Unless notified otherwise, the following rules shall be considered the minimum required and shall be adhered to by General Contractor, their employees and visitors. Anyone violating these rules may be denied further access to the Site.

4.9.1.2.1 Safety Materials and Inspection. Jobsite "tailgate" meetings will be held weekly for Contractor's employees, temporary and permanent. Tailgate safety meetings are held for construction crews' benefit. Employees shall be required to attend the meetings and encouraged to participate and offer suggestions for improving safe work conditions and or practices. The Contractor foreman will make a daily safety inspection of the job-site, documenting activities on the Daily Jobsite Inspection Report provided. Any unsafe work conditions or unsafe acts by Contractor employees or subcontractor will be noted and immediate corrective action taken.

4.9.1.2.2 Protective Clothing & Safety Equipment. The Contractor and/or its personnel must wear appropriate safety clothing and use appropriate safety equipment. The instruction for proper use and maintenance of personal safety equipment and protective clothing is also the responsibility of the Contractor. This includes, but is not limited to, safety glasses, welding goggles, safety shoes, respiratory protection gear (in special cases), ear protection and hard hats, as described below.

Personnel shall wear approved hard hats at all times in construction areas.

Personnel shall wear proper footwear and/or safety-toed shoes or boots with substantial soles. Additional foot protection, such as rubber boots or steel-toed protectors may be required where there is exposure to special hazards.

Wear safety glasses, goggles, or face shields whenever there is an exposure to injury from flying particles or splash. Eye protection is particularly required when grinding, cutting, chipping, welding, or using air tools for such things as breaking concrete.

Use proper respiratory equipment whenever there is exposure to harmful dusts, fumes, vapors, or gases.

Whenever personnel is working on foot and exposed to mobile equipment or motor vehicle traffic, personnel must wear orange flagger's vests or other equivalent high visibility orange apparel. If vests are used after dark, they must be of the reflective type.

Personnel shall wear protective gloves and boots whenever working with cement products, acids, or chemicals.

Personnel must wear hearing protection such as plugs, or muffs as directed or whenever exposure to noise exceeds 85 decibels. In general, if you need to shout in order to converse with a person close by, you should ask your Supervisor if ear protection is required.

4.9.1.2.3 Personnel Behavior. Smoking is prohibited on Sequoias Community College District property.

Control noise so as not to disturb or disrupt Owner, District or other Contractor Personnel. No radios or portable headsets will be permitted without prior approval.

The use or possession of intoxicating beverages or drugs on the jobsite or immediately prior to entering the job site is prohibited.

Do your part to help keep work areas clean and free of debris and other tripping hazards.

Firearms are not permitted on the job site, inside vehicles or equipment.

With safety issues in mind, keep a lookout for other persons and employees that come into the vicinity of your work area.

Only those Contractor vehicles actually required for delivery of equipment and materials or for the performance of necessary operations by the Contractor will be admitted to the site. The speed limit of five (5) mph will be observed. No personal vehicles are allowed.

All Contractor safety signs, notices and tags must be obeyed. The Contractor must display appropriate safety signs, notices and barriers when work is in progress that could be hazardous.

4.9.1.2.4 Anti-Harassment Policy. Harassment, creation of a hostile work environment or intimidation for the purpose of interfering with work will not be permitted. Anti-harassment policies and supervisory training will be conducted regularly to eliminate vulgar comments, demeaning comments, offensive graffiti or creation of sexually hostile work behavior.

4.9.1.2.5 Hand and Portable Electric Tools: Contractor and/or its personnel shall do the following:

a. Always use the right tool for the job.
b. Do not use defective tools or equipment.
c. Report tools or equipment to your Supervisor that are broke or do not work properly so that they can be replaced with safe ones.
d. Keep guards and safety devices in place and functioning properly.
e. Inspect electric cords, plugs and receptacles before use and have them repaired or replaced if worn or damaged.
f. Electric cords should not be spliced and taped. If portable electric service is provided to the job-site, each fifteen (15) and twenty (20) amps receptacle must have grounding contacts through a ground fault interrupter circuit, or an assured equipment ground conductor maintenance program in progress.
g. Be certain that all electric hand tools and exposed non-current carrying parts of motors, generators (including portable units), and control equipment are properly grounded.
h. Do not use the power cord to lift or lower portable electric tools since this practice can break internal wiring and cause electric shorts. All electrical equipment used is to be a type appropriate to the hazard classification of the area where work is to be performed and compiling with all applicable governmental standards and Contractor's maintenance procedures.

4.9.1.2.6 Ladders. All ladders, scaffolding and etc. must be OSHA and Cal/OSHA approved.

All trades performing work shall have and implement a fall protection plan suitable for the site, activities, height and other conditions. Guardrails are required to guard the open sides of all work surfaces that are seven and a half (7 ½) feet or higher. A personal fall restraint system, which consists of anchorages, connectors, body belt and harness, and may include lanyards, lifelines, and rope grabs, shall be used to prevent an employee from falling.

Ladders should be inspected before use. Well built, undamaged ladders of the proper size should be used and should be long enough that side rails extend three feet above the landing. Metal ladders should not be used when working on electrical equipment since the ladders conduct electricity.

Contractor and/or its personnel should always do the following when using ladders:

a. All ladders should have safety feet in good condition.
b. When setting the ladder, the base should be approximately one-fourth the length to its top support.
c. Secure ladders from falling by setting feet properly and tying them off at the top to prevent them from sliding over.
d. Face the ladder when going up or down and keep hands free of tools or materials.
e. Always bring materials up ladder using a hand line.

4.9.1.2.7 Scaffolds, Platforms and Safety Belts. Contractor and/or its personnel shall do the following:

a. Before using scaffolds or other work platforms, check them for security, proper planking and guardrails. They must conform to design standards or be designed by a licensed engineer.
b. Wood pole scaffolds must be tied every twenty (20) feet horizontally and vertically for light trades, and fifteen (15) feet for heavy trades. Metal scaffolds must be tied every twenty-six (26) feet vertically and thirty (30) feet horizontally. A permit from Cal-OSHA is required for a scaffold over thirty-six (36) feet high.
c. Scaffold platforms must have guardrails on the open sides if over seven and a half (7-1/2) feet high. One set of "X" braces is sufficient if they intersect twenty (20) to thirty-six (36) inches above the platform. Toe boards are required where workers pass below. Access to scaffolds must be safe and unobstructed.
d. Do not use single plank for ramp access to work areas. A ramp must be at least twenty (20) inches wide and have handrails if it is seven and a half (7-1/2) feet or more in height. Keep ramps and platforms clear of debris and unnecessary tools and material. When rolling scaffolds are used, height-to-base ratio must not exceed a 3:1 ratio, all wheels must be locked when in use, and work platform must be fully guarded. Rolling scaffolds should not be moved with someone on them.
e. Approved safety belts with lifelines or lanyards must be worn when you are exposed to falls from heights that would otherwise require guardrails or other fall protection. When working on roofs, every effort should be made to protect from falls by safety belts/lifelines, or by safety nets if working above twenty-five (25) feet in height. If there is danger of falls on roof edges, guard lines can be installed forty-two (42) inches high and approximately five (5) feet from the edge to warn roofers before they get too close.

4.9.1.2.8 Fire and Flammable Materials. With respect to fire and flammable materials, Contractor and/or its personnel shall also do the following:

a. All flammable liquids are to be stored only in approved closed metal containers, labeled FLAMMABLE.
b. Keep combustible waste materials picked up and discarded regularly.
c. Know the location and proper use of fire extinguishers and use only for firefighting.

d. Use proper precautions when transferring fuel or refueling equipment. Stop motors, provide for grounding and bonding and do not smoke or allow open flames or other source of ignition in the area. Close containers tightly and eliminate any spillage. Remember that the vapors from flammable liquids can carry away from the liquid itself and are easily ignited.
e. Oxygen and acetylene cylinders are to be secured upright and stored separately (at least twenty (20) feet apart or separated by a fire-resistant wall at least six (6) feet high, and not near other combustible materials, particularly oil and grease). Protective caps should be kept in place when they are not in use.
f. Never weld, burn or cut any containers that have held flammable liquids unless they are filled with water or are completely cleaned, ventilated and tested.
g. Never use gasoline for cleaning purposes. Use only approved cleaning solvents, in well ventilated areas.
h. All compressed gas cylinders must be stored in an upright position and secured against falling.

4.9.1.2.9 Hazardous Substances. Contractor and/or its personnel may be exposed to many different materials that have been determined to be hazardous substances if they are not handled in a safe manner. Contractor and/or its personnel shall know what information on hazardous substances is available and how to use it. Material Safety Data Sheet (MSDS) for each of the hazardous substance used shall be maintained on the job site by Contractor foreman. These are the rules when using hazardous substances:

a. Never use any chemical or substance without reading the label or the MSDS.
b. If you have questions or have not been instructed on the safe use of hazardous substances; seek clarification.

4.9.1.2.10 Contractor Machinery & Equipment. The Contractor shall not use District's equipment or tools. The Contractor must supply all such items necessary to complete the work of its trade. Contractor and/or its personnel shall do the following:

a. Only operate, service or repair machinery or equipment that it is qualified to operate or service.
b. Before operating any power-driven equipment or vehicles, make a careful Safety inspection. Any defects must be repaired before the equipment is operated.
c. Before starting machinery or putting equipment in motion, make certain there will be no danger to other persons or property.
d. The use of seat belts is required when operating motor vehicles or mobile earth moving equipment.
e. Never service or repair machinery or equipment while it is in motion. Always lock-out machinery or equipment being serviced to prevent possible injury.

f. When mounting or dismounting equipment, always use the stairs or ladder. Never try to jump off.
g. Never ride any machinery, equipment, loads, or hooks unless in the seat provided by manufacturer or approved safety facilities or devices are used.
h. Equipment must never be operated within fifteen (15) feet of energized high voltage electrical lines. Fifty-thousand (50,000) volts and higher voltage requires greater distances in accordance with State and Federal Safety Regulations.
i. Always stay outside the area within the swing radius of rotating machines such as cranes, shovels, or a backhoe.
j. All equipment must be safely parked and secured before it is left unattended, even for short periods of time. Particularly lower all forklift beams, blades, booms, buckets, etc. to the ground and secure from possible movement.
k. When mobile equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

4.9.1.2.11 Cranes. Hazards associated with crane operation including electrocution from overhead power lines, equipment failures because of operator error, faulty or damages equipment, overloading or lack of support are to be avoided at all times. Workers must be thoroughly familiar with hand signals used for communication with the crane operator. Slings and attachment must not be kinked, shortened by knots, bolts or other means, and must be inspected on a daily basis for defects.

Aerial devices, such as cherry pickers, lifts, and boom trucks used to position personnel, must observe continuous safety precautions. Only authorized persons may operate aerial devices. Aerial devices must not rest on any structure, only solid ground. Controls must be tested before use. Workers must stand only on the floor of the basket. No planks, ladders, or other means are allowed to gain greater height. A fall protection system must be worn and attached to the boom or basket. Brakes must be set when employees are elevated. An aerial lift truck must not be moved when an employee is on the elevated boom platform.

Contractor and/or its personnel shall do the following:
a. The crane operator must be in good condition physically, mentally, and emotionally in order to maintain complete control of the crane at all times.
b. Before starting the crane do a preoperational inspection. This inspection is to be documented in writing on the daily inspection and maintenance log, and initialed by the inspector.
c. Be mindful of specific jobsite restrictions, such as the location of overhead electric power lines, unstable soil, and high wind conditions.

d. To prevent employees from being struck or crushed by the crane, barricade accessible areas within the swing radius of the rear of the rotating superstructure.
e. Never work under a suspended load. When a load is being picked up or set down, it may shift, swing, or pivot, or a loose piece may even fall off; make sure that you keep far enough back to accommodate the dangers. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations.
f. Crane operators must avoid swinging loads over persons and should keep people away from loads when possible.
g. Crane attachments cannot exceed the capacity, rating, or scope recommended by the manufacturer. Operators must be knowledgeable of and operate within crane capacities and limitations. If the operator does not have a clear, unobstructed view of the entire lift, from beginning to end, a signal person must be assigned.

4.9.1.2.13 Hazardous Atmospheres. Never enter any confined space such as a trench, excavation, manhole, underground vault, tank, pipes, etc. without first determining if there is adequate ventilation and that there are no flammable or toxic gases. Then enter only with permission of your Supervisor and with proper safety devices such as a lifeline and another person standing by for help as necessary.

Testing and Controls: In addition to the requirements set forth in the construction Safety Orders and the General Industry Safety Orders to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements shall apply:

a. Where oxygen deficiency (atmospheres containing less than nineteen and a half percent (19.5%) oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than four (4) feet in depth.
b. Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than nineteen and a half percent (19.5%) oxygen and other hazardous atmospheres. These precautions include proper respiratory protection or ventilation.
c. Adequate precaution shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of twenty percent (20%) of the lower flammable limit of gas.
d. When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable level, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

e. Emergency Rescue Equipment: Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in sue.
f. Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, shall wear a harness with a lifeline securely attached to it. The lifeline shall be separate from any line used to handle materials and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

4.9.1.2.14 Hazards Associated with Water Accumulation. Contractor and/or its personnel shall do as follows:

a. Not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect personnel adequately vary with each situation but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.
b. If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operations.
c. If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with provisions previously stated in Excavation, Trenches, and Earthwork.

4.9.1.2.15 Stability of Adjacent Structures. Contractor and/or its personnel shall do as follows:

a. Where the stability of adjoining building, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of personnel.
b. Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to personnel shall not be permitted except when:
    i. A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
    ii. The excavation is in stable rock; or
    iii. A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

c. Sidewalks, pavements, and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

4.9.1.2.16 Hazardous Conditions. Maintain access to fire hydrants and fire alarm boxes at the work site. Hydrants, alarm boxes and standpipe connections shall be kept clear of obstructions and kept visible at all times. If visibility cannot be maintained, the Contractor shall provide clearly visible signs showing the location of the fire hydrant, fire alarm box, or standpipe connection.

Existing sprinkler systems are not to be shut down, restored, disconnected, or modified without authorization by Contractor. Sprinkler pipes are not to be used as supports or as grounds for welding equipment.

No open flames, welding, cutting, open electrical equipment, or other spark-producing equipment will be operated within the site or buildings without proper precautions. The Contractor shall bear total responsibility for ensuring that proper precautions are taken.

Control at all times any fumes and/or vapors emitted by material used so as not to create a health hazard, interfere with, or be noticeable by Owner, Contractor or the personnel of other Contractors.

Contractor shall control dust in such a manner so as to not cause an impact or interfere with other work, systems, or operations.

Contractor will be responsible for insuring that all open holes, open ledges, etc. are protected from accidental entry by providing physical barriers in accordance with OSHA and Cal/OSHA standards.

20. Safety.
Article 4.9 of the General Conditions is modified by addition of the following:

4.9.8 Protection and Safeguarding the Work. Contractor shall provide such lights, barricades, guardrails, posted signs, and other protective measures as may be required for the safe operation of the work or as directed by governing authorities.

21. Safety.
Article 4.9 of the General Conditions is modified by addition of the following:

4.9.9.1 Work Area. Contractor personnel are permitted only in the specific areas where their work is being done; travel through other parts of the building and site is prohibited except as necessary to reach the work site. Use of District's office, office equipment and toilet is prohibited. The project site will have limited space available for storage of materials. The Contractor and District's representative will prearrange

all construction areas, storage areas, etc. prior to start of work. The District shall allocate space at the Site for storage and staging by the Contractor. The District's decision regarding allocation of Site space for storage/staging are final and shall not result in any adjustments of the Contract Time or the Contract Price for any Contractor.

4.9.9.2 Forklift, Hand Jacks and Construction Equipment. Under no circumstances should anyone other than a properly trained and certified person operate a forklift. Drivers must be sure that there is clear visibility in all directions before driving. The riding on equipment except in the seat provided by the manufacturer is strictly prohibited.

4.9.9.3 District Machinery & Equipment. The Contractor shall not use District machinery, equipment, or tools. The Contractor must supply all such items necessary to complete the job.

4.9.9.4 Flammable Material. No flammables shall be stored or left unattended in any of the buildings or structures.

4.9.9.5 Electrical Equipment. All electrical equipment used is to be a type appropriate to the hazard classification of the area where work is to be performed and compiling with all applicable governmental standards and District's maintenance procedures.

22. Use of Site.

Article 4.11 of the General Conditions is modified by addition of the following:

4.11.1 Storage of Materials. District will assign to Contractor allowable areas at the Site for the storage or materials and equipment. Contractor shall keep his materials and equipment strictly within the limits and areas assigned by District. Items stored pursuant to the foregoing shall cause no obstruction and shall be stored off sidewalks, roadways and underground services and utilities. Contractor shall be responsible for protecting his materials and equipment inside secured and locked storage containers.

23. Clean-Up.

Article 4.12 of the General Conditions is modified by addition of the following:

4.12.1 Removal of Surplus Materials and Waste. At the end of each work day, Contractor shall remove all surplus equipment, materials, construction debris, waste and rubbish of every sort, and leave the Site in a clean, neat, orderly and safe condition. Contractor shall dispose of removed lighting ballasts and fixtures in a legal manner and provide the District with a manifest.

24. Record Drawings.

Article 1.19 of the General Conditions is modified by addition of the following:

1.19.1 Project Closeout. Record Drawings shall be reviewed and approved by the Project

Inspector and/or District representative prior to consideration for Final Acceptance of the Work by the District. Contractor shall provide the District with two (2) full-size color copies of digitally scanned files of the Record Drawings (PDF file(s) saved on separate CDs or memory sticks). This requirement must be fulfilled by the Contractor before Notice of Completion can be filed for the Project.

25. Addition or Deletion of Alternate Bid Item(s).

Article 9.4.3 of the General Conditions is modified by addition of the following:

9.4.3.1 Definition of Alternate Bid Item. Alternate Bid Item: An Amount proposed by Bidders and stated on the Bid Proposal form for certain work defined in the Bidding Requirements, Specifications and/or Drawings that may be added or deducted from the Base Bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents. The cost or credit for each Bid Alternate Item is the net addition to or deduction from the Contract Sum to incorporate Alternate Bid Item(s) into the Work. No other adjustments are made to the Contract Sum.

9.4.3.2 Bidding Requirements for Alternate Bid Item(s). Provide all material, labor, equipment, and services necessary to completely install or remove all materials, accessories and other related items necessary to add or delete from the Project as indicated by the Bid Alternate Items in the Contract Documents. When Deductive Alternates are incorporated into the Contract, any services, such as utilities, that are meant to pass through the Deductive Alternate areas that serve other areas of the Base Bid Work shall be maintained as part of the Base Bid whether indicated or not.

9.4.3.3 Quality Assurance. Contractor shall execute accepted Bid Alternate Item(s) under the same conditions as other Work of the Contract.

26. Daily Progress Reports.

Article 4.20 of the General Conditions is modified by addition of the following:

4.20.1 Weekly Progress Reports. Upon prior approval by District, Contractor may substitute the daily progress report requirement by providing District with a weekly progress report identifying the work completed in the prior week and a projection of work to be completed in the current week. The report may be submitted via email to the Facilities Office (Attn: Byron Woods) not later than 12:00 p.m. of each Monday during the duration of the Project.

[End of Section]

SECTION 011100

SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work by separate contracts.
6. Owner furnished, contractor installed products.
7. Access to site.
8. Coordination with occupants.
9. Work restrictions.
10. Specification and drawing conventions.

B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification:

Student Union Building
College of Sequoias – Visalia Campus
915. S Mooney Blvd.
Visalia, CA 93277

Architect’s Project Number: 22-12499

DSA Application Number: 02-123516

B. Owner:

College of Sequoias Community College District
915 S. Mooney Blvd.
Visalia, CA 93277

Telephone: (559) 730-3908
Contact: Bryon Woods, byronw@cos.edu

C. Architect:

TETER, Inc.
7535 North Palm Avenue, Suite 201
Fresno, California 93711

Telephone 559.437.0887
Contact: Steven Polanco

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

1. Demolition of existing building and site infrastructure for the construction of a new Student Union building and associated site work.

B. Type of Contract: Project will be constructed under a single prime contract.

1.5 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

1. <Insert a brief description of work performed by Owner>.

C. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. <Insert a brief description of work performed by Owner>.

D. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1. <Insert a brief description of work performed by Owner>.

1.6 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Preceding Work: Owner [has awarded] [will award] separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

1. <Insert name of the Contract>: To <Insert name of separate Contractor> [to] [for] <Insert a brief description of work performed under separate contract>.

C. Concurrent Work: Owner [has awarded] [will award] [and will assign to the Contractor] separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract. (REF

1. <Insert name of the Contract>: To <Insert name of separate Contractor> [to] [for] <Insert a brief description of work performed under separate contract>.

D. Subsequent Work: Owner [has awarded] [will award] separate contract(s) for the following additional work to be performed at site following Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1. <Insert name of the Contract>: To <Insert name of separate Contractor> [to] [for] <Insert a brief description of work performed under separate contract>.

1.7 OWNER-FURNISHED CONTRACTOR-INSTALLED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.

B. Owner-Furnished Products:

1. <**Insert description, in separate subparagraphs, for each Owner-furnished product**>.

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

C. Limits on Use of Site: Limit use of Project site to the Project area indicated and site areas allowed for Contractor’s use. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.9 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and [existing] [adjacent] building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify the Owner not less than [72] <Insert number> hours in advance of activities that will affect Owner's operations.

B. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than [72] <Insert number> hours' notice to Owner of activities that will affect Owner's operations.

C. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.10 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Submit a written request to the Architect for work hours outside of the indicted on-site hours; request subject to review by the Owner.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Architect and Owner not less than 2 days in advance of proposed utility interruptions.
2. Obtain Architect’s and Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Architect and Owner not less than 2 days in advance of proposed disruptive operations.
2. Obtain Architect’s and Owner’s written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted.

F. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements shall be complied with by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

1. Where conflicts occur between Division 00 Contracting Requirements and Division 01 General Requirements, the most restrictive requirements shall apply; Architect shall make the final decision on which requirement(s) apply.

D. Drawing and Specification Coordination:

1. Requirements for materials and products identified on Drawings are described in detail in the Specifications unless materials and products are described in detail on the Drawings.

2. Generic terms are used to identify materials and products on the Drawings.
3. Specifications establish minimum quality standards for products, materials, and installation requirements unless more stringent requirements are indicated on the Drawings; Drawings establish material and product location and quantity.
4. Where requirements for materials and products indicated on the Drawings are not specified, provide heavy duty commercial grade products and materials.

1.12 MISCELLANEOUS PROVISIONS

A. <**Insert miscellaneous provisions**>.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 011103

ADDENDA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative requirements for Addenda issued prior to bid opening.

B. Related Requirements:

1. Division 00 Sections as applicable to contract requirements and modifications.
2. Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
3. Division 01 Section "Contract Modification Procedures" for changes to the Contract Documents after award of the Contract.

1.3 NOTICE TO BIDDERS

A. Addenda will be issued to registered plan holders for changes to the drawings and specifications during the bidding period prior to the bid opening. Addenda shall serve to clarify, revise, and supersede information in the Project Manual, Drawings, and previously issued Addenda. Portions of the Addenda affecting the Contract Documents will be incorporated into the Contract by enumeration of the Addendum in the Owner/Contractor Agreement.

B. The Bidder shall acknowledge receipt of this Addendum in the appropriate space on the Bid Form.

1.4 GOVERNING AGENCY REVIEW AND APPROVAL

A. Addenda shall be submitted to the Authority having Jurisdiction (AHJ) by the project Architect and shall be approved by the AHJ in order to be officially incorporated into the construction documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 011105

USE OF ARCHITECT'S ELECTRONIC FILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes Administrative and procedural requirements for use of Architect's electronic Contract Document drawing files.

B. Related Sections:

1. Division 01 Section "Project Management and Coordination."
2. Division 01 Section "Submittal Procedures."
3. Division 01 Section "Project Record Drawings."

1.3 USE OF ARCHITECT'S ELECTRONIC FILES

A. Architect may make available to Contractor digital data files of Architect's Drawings for use in preparing shop drawings, coordination drawings, and project record drawings.

1. Electronic files will be available without charge.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
3. Files will be supplied digitally via email or FTP site and will be in PDF, DWG, or similar common format.
4. Waiver of Liability: Contractor, Subcontractors, and Suppliers of this Project shall each execute a waiver of liability for each use of the Architects electronic files.
    a. Waiver of Liability form shall be submitted to the Architect at the time or request for use of Architect's electronic data files.
    b. Waiver of Liability form shall be the "ELECTRONIC DATA FILE DISTRIBUTION WAIVER OF LIABILITY FORM" included at the end of this Specification Section.
    c. The use of the electronic files shall only be used for this Project and for the identified purposes noted in the Waiver of Liability form.
        1) Each entity shall be responsible for complying with the restrictions of the Liability Waiver form.
        2) Electronic Contract Document drawing files received from the architect shall not be duplicated without written permission of the Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

(Electronic Data File Distribution Waiver of Liability included on the following page)

TETER
ARCHITECTS ENGINEERS CONNECTED

ELECTRONIC DATA FILE DISTRIBUTION WAIVER OF LIABILITY

TETER
7535 North Palm, Suite 201
Fresno, California 93711

Project: _____

Intended Use: _____

Any electronic data, files or information provided under this Agreement are the property of the above listed Professionals and consultants (Team). It is understood and agreed that the information contained in these electronic data file shall not be copied or duplicated for any use other than the project for which they were created. It is understood by the undersigned that compatibility of this electronic media with other systems is not guaranteed, and conversion to other systems is done at the user's own risk.

The user hereby agrees and recognizes that designs, plans and data stored on electronic media including, but not limited to, computer disk and magnetic tape, may be subject to undetectable alteration and/or uncontrollable deterioration. It is agreed by the undersigned that the Team shall not be liable for the completeness or accuracy of any material provided on electronic media.

The undersigned agrees to defend, hold harmless and indemnify the Team and its officers, directors, employees, agents and consultants for any and all claims, losses, costs or damage whatsoever arising out of, resulting from, or in any way related to the use of electronic data files provided hereunder, whether that use is authorized or unauthorized. The user further agrees to defend, indemnify and hold harmless the Team its officers, directors, employees, agents and consultants from any and all claims, damages, losses, expenses and injuries arising out of the modification of the electronic data files by the user or by anyone obtaining said files through or from the user.

The Team bears no responsibility for the information in the electronic data files once it leaves the offices of **TETER**. The undersigned understands that the electronic data files are subject to applicable copyright laws of the United States and agrees to be bound by same. Upon our receipt of this agreement duly executed by an Officer of your firm you may request the Data files.

Name (Print/Sign): _____ Date: _____

Firm: _____ _____

Phone and email: _____ _____

Name (Print/Sign): _____ Date: _____

Firm: _____ _____

Phone and email: _____ _____

Name (Print/Sign): _____ Date: _____

Firm: _____ _____

Phone and email: _____ _____

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Sections:

1. Division 00 Section “Instructions to Bidders” and other Division 00 Sections as applicable to substitution requests prior to submission of bids.
2. Division 01 Section “DSA Hourly Fee Services” for DSA hourly fee services for review of changes to DSA approved Construction Documents.
3. Division 01 Section “Contract Modification Procedures” for changes to DSA approved Construction Documents.”
4. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
5. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor that are not required in order to meet other Project requirements but may offer advantage to the Owner.

1.4 REGULATORY REQUIREMENTS

A. Division of the State Architect (DSA) Review and Approval: Substitutions resulting in changes to DSA approved Construction Documents may be considered a change requiring DSA review and approval and submission of a DSA Construction Change Document (CCD) form by the Architect.

1. DSA Construction Change Documents shall be as specified in Division 01 Section “Contract Modification Procedures.”
2. DSA Hourly Fee Services for review of CCD’s shall be as specified in Division 01 Section “DSA Hourly Fee Services.”

1.5 SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title, and Drawing numbers and titles.

1. Substitution Request Form: Use form provided at the end of this Section.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.
    g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
    j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
    k. Cost information, including a proposal of change, if any, in the Contract Sum.
    l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later. Architect will not act on any Post-Bid Substitutions until 7 days following the submission of the Schedule of Values per Division 01 Section “Payment Procedures.”

   a. Forms of Acceptance:

      1) Substitutions Prior to Bid: Addenda will be issued for substitutions accepted at least 3 days prior to bid.
      2) Substitutions After Award of Contract: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.6 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.7 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.8 SUBSTITUTIONS

A. Substitutions Prior to Bid: Architect will consider requests for substitution if received within 21 days prior to the submission of bids. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider bidder’s request for substitution when the following conditions are satisfied.

   a. Substitutions prior to bid shall also be subject to the requirements of applicable Division 00 Specification Sections.
   b. Substitutions prior to bid shall comply with the requirements for Substitutions for Cause or Substitutions for Convenience as applicable.

2. Substitutions requested by bidders during the bidding period, and accepted by Addendum prior to award of the Contract, are considered as included in the Contract Documents.

B. Substitutions After Award of Contract: The Contractor after award of the Contract, as allowed by the General Conditions, may submit materials and methods to be considered for substitutions.

1. The following are not considered to be substitutions:

a. Revisions to the Contract Documents requested by the Owner or Architect.
b. Specified options of products and construction methods included in the Contract Documents.
c. The Contractor’s compliance with governing regulations and orders issued by governing authorities.

C. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 21 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

D. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

(Substitution Request Form included on the following page)

Substitution Request Form

Corporate Headquarters
7535 N. Palm Ave. #201
Fresno, CA 93711

559.437.0887 T
559.438.7554 F
teterae.com

FOR: **COS – Student Union**

We hereby submit for your consideration the following product instead of the specified item for the above project:

SECTION	PARAGRAPH	SPECIFIED ITEM

Proposed Substitution: _____

Attach complete technical data, including laboratory tests, if applicable.

Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proposed installation.

Fill in the blanks below:

A. Does the substitution affect dimension on Drawings:

_____

B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution?

_____

C. What affect does substitution have on other trades?

_____

D. Difference between proposed substitution and specified item?

_____

E. Manufacturer's guarantees of the proposed and specified items are:

_____ Same _____ Different (explain on attachment)

F. Cost difference between proposed substitution and specified item - savings to Owner?

_____

The undersigned states that the function, appearance and quality are equivalent or superior to the specified item and will be at no additional cost to the Owner.

Submitted to the Architect by:

Signature: _____

Firm: _____

Address: _____

_____

Date: _____

Telephone: _____

Remarks: _____

For Use by Design Consultant

Accepted _____
Accepted as Noted _____
Not Accepted _____
Received Too Late _____

By: _____

Date: _____

SECTION 012600

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications including the following:

1. Governing Agency approval.
2. Bulletins.
3. Architect’s Supplemental Instructions.
4. Architect’s Change Directive.
5. Requests for Proposals.
6. Change Order Requests.
7. Cost Change Directives.
8. Change Orders.

B. Related Requirements:

1. Division 00 Sections as applicable to contract requirements and modifications.
2. Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
3. Division 01 Section “DSA Hourly Fee Services” for fees charged by DSA for changes to the Construction Documents.

1.3 DEFINITIONS

A. Contract Modification: A change to the Contract Agreement between the Owner and the Contractor affecting the Contract Documents, the Contract Time, and/or the Contract Amount.

1.4 GOVERNING AGENCY APPROVAL

A. DSA Approval: Changes to DSA approved Construction Documents shall be reviewed and approved by DSA.

1. Changes to DSA Approved Construction Documents shall comply with requirements of DSA Interpretive Regulation IR A-6, “Construction Change Document Submittal and Approval Process” and shall be accompanied by DSA Form 140 “Application for Submittal of Post-Approval Document.”
2. Architect shall be responsible for preparing Construction Change Documents and submitting documentation to DSA.

B. DSA Hourly Fee Services: Changes to DSA approved Construction Documents shall be reviewed by DSA and shall be subject to DSA Hourly Fee Services. Charges will be made to the Owner by DSA.

1. Where changes to DSA approved Construction Documents are the result of actions by the Contractor, the Contractor shall be liable for DSA Hourly Fee Services as described in Division 01 Section “DSA Hourly Fee Services.”

1.5 BULLETINS

A. Bulletins: A form used by the Architect for issuing Architect’s Supplemental Instructions (ASI), Architect’s Change Directives (ACD), and Requests for Proposals (RFP).

1.6 ARCHITECT’S SUPPLEMENTAL INSTRUCTION

A. Architect’s Supplemental Instruction (ASI): Supplemental instructions will be issued by the Architect authorizing minor changes in the Work not involving adjustment to the Contract Sum or the Contract Time.

1. Architect’s Supplemental Instructions will be issued via Bulletin and signed by the Architect.
2. Contractor’s Response: Contractor shall perform the work indicated in the Architect’s Supplemental Instruction without adjustment to the Contract Sum or the Contract Time. If the Contractor determines that an adjustment to the Contract Sum or the Contract Time is necessary due to the Architect’s Supplemental Instruction, the Contractor shall respond to the Architect’s Supplemental Instruction as if it were an Architect/Owner initiated Request for Proposal.

B. DSA Review and Approval: Architect’s Supplemental Instructions affecting changes to the DSA Approved Construction Documents shall be subject to DSA review and approval; Architect shall submit applicable DSA CCD documentation to DSA for approval.

1.7 ARCHITECT’S CHANGE DIRECTIVE

A. Architect’s Change Directive (ACD): Architect’s Change Directives will be issued by the Architect instructing the Contractor to proceed with a change in the Work for subsequent inclusion in a Change Order.

1. Architect’s Change Directives will be issued via Bulletin and signed by the Architect.

2. Architect’s Change Directives contain a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation by Contractor: Maintain detailed records on a time and material basis of work required by the Architect’s Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

C. DSA Review and Approval: Architect’s Change Directives affecting changes to the DSA Approved Construction Documents shall be subject to DSA review and approval; Architect shall submit applicable DSA CCD documentation to DSA for approval.

1.8 REQUEST FOR PROPOSALS

A. Requests for Proposals: Requests for Proposals are Architect/Owner initiated requests for estimates of changes to the Contract Sum and/or Contract Time for proposed changes; Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. The description may include supplemental or revised Drawings and Specifications.

1. Requests for Proposals will be issued by the Architect via Bulletin.
2. Requests for Proposals are not authorization or instructions to either stop work in progress or execute proposed change(s).
3. Contractor’s Response: Within not more than 7 days after receipt of Request for Proposal, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use forms acceptable to Architect.

B. Architect’s Response: Within 7 days after receipt of Contractor’s response to Architect/Owner initiated Request for Proposal, Architect will:

1. Issue a Change Order or Cost Change Directive for accepted proposals.
2. Notify the Contractor of unaccepted proposals.
3. Issue an Architect’s Change Directive where changes are necessary for the progress of the Work and changes to the Contract Sum and the Contract Time are in dispute.

1.9 CHANGE ORDER REQUEST

A. Change Order Request (COR): Change Order Requests are documents initiated by the Contractor requesting a Contract Modification due to unforeseen conditions, or latent or changed conditions.

1. Change Order Request Form: Use form acceptable to Architect.
2. Include a statement outlining reasons for the Change Order Request and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
3. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
5. Include costs of labor and supervision directly attributable to the change.
6. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
7. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

B. Architect’s Response: Within 7 days after receipt of Contractor’s Change Order Request, Architect will:

1. Issue a Cost Change Directive for accepted Change Order Requests that do not require changes to the approved Construction Documents.
2. Issue a Change Order and/or Cost Change Directive for accepted Change Order Requests that require changes to the approved Construction Documents.

    a. Where Change Order Requests require changes to the Contract Documents, Architect will provide a detailed description of proposed changes in the Work via Change Order.

3. Issue an Architect’s Change Directive where changes are necessary for the progress of the Work and changes to the Contract Sum and the Contract Time are in dispute.
4. Notify the Contractor of unaccepted proposals.

1.10 COST CHANGE DIRECTIVE (CCD)

A. Cost Change Directive: A Cost Change Directive is a document issued by the Architect notifying Contractor of Owner’s acceptance of changes to the Contract Sum proposed by the Contractor.

1.11 CHANGE ORDERS

A. Change Orders: Change orders are a document defining Contract Modifications; upon Owner's approval of proposed Contract Modifications, Architect will issue a Change Order for signatures of Owner and Contractor on form provided by Architect.

B. DSA Review and Approval: Change Orders affecting changes to the DSA Approved Construction Documents shall be subject to DSA review and approval; Architect shall submit applicable DSA CCD documentation to DSA for approval.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012605
DSA HOURLY FEE SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Division of the State Architect (DSA) Interpretive Regulation IR A-30 “DSA Hourly Fee Services” latest edition (Document is available on DSA’s website under “Publications;” Interpretive Regulations (IRs); A- Administrative; IR-30).

https://www.dgs.ca.gov/dsa/

1.2 SUMMARY

A. Section includes administrative and procedural requirements for DSA Hourly Fee Services associated with changes to DSA approved Construction Documents.

B. Related Requirements:

1. Division 00 Sections as applicable to contract requirements and modifications.
2. Division 01 Section "Addenda."
3. Division 01 Section "Substitution Procedures."
4. Division 01 Section "Contract Modification Procedures."
5. Division 01 Section "Payment Procedures."
6. Division 01 Section "Submittal Procedures."
7. Division 01 Section "Product Requirements."

1.3 DSA HOURLY FEE SERVICES

A. General: Changes to DSA approved Construction Documents shall be documented by the use of DSA Construction Change Document (CCD) forms. CCD forms shall be submitted to DSA by the Architect.

1. Refer to Division 01 Section “Contract Modification Procedures” for additional information regarding DSA CCD’s.

B. DSA Hourly Fee Services: Changes to DSA approved Construction Documents shall be reviewed by DSA and shall be subject to DSA Hourly Fee Services for review at a rate established by DSA IR A-30. Charges will be made to the Owner by DSA.

1. Hourly Rate: Rate per hour as established by DSA IR A-30, latest edition.

C. Bidder's Responsibility: Prior to bidding, where a bidder's request for substitution or similar action results in a change requiring DSA Hourly Fee Services, bidder shall submit a deposit to the Architect for reimbursement for DSA Hourly Fee Services. The deposit amount shall be established by the Architect, a minimum of one hour of DSA Hourly Fee Services (hourly rate as established by DSA IR A-30) will not be refundable. Deposits shall be made payable to the Owner.

D. Contractor's Responsibility: When a contractor's action results in a change requiring DSA Hourly Fee Services, charges by DSA to the Owner will be deducted from the Contract Sum and the Architect will issue a Change Order on a quarterly basis to adjust the Contract Sum.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012613
REQUEST FOR INFORMATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for preparation, submittal and response to Contractor’s Request for Information (RFI’s) during construction of project.

1.3 DEFINITIONS

A. RFI, Request for Information: Request from Contractor seeking information required by or clarification of the Contract Documents.

1.4 SUBMITTALS

A. RFI Submittals: Submit RFI’s via email as PDF electronic files; include attachments in PDF electronic file format.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Form: Use RFI form included at end of this Section or form acceptable to Architect. Upon request from the Contractor, the form at the end of this section will be made available in WORD format from the Architect.

D. Architect's Action: Architect will review each RFI, determine action required, and respond.

1. Allow 10 working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
2. Architect will not act on any RFI’s until 7 days following the submission of the Schedule of Values per Division 01 Section “Payment Procedures.”
3. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor’s means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

4. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
5. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

6. Distribution: The Architect shall distribute one electronic copy of each completed RFI review to the Contractor and the Owner.

E. Regulatory Requirements: Architect's responses that modify the Contract Documents affecting Structural Safety, Fire and Life Safety, and/or Access Compliance shall be submitted to the Division of the State Architect for review and approval.

1. Changes to DSA approved Construction Documents shall be as specified in Division 01 Section "Contract Modification Procedures."

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the sequential RFI number. Submit log weekly unless otherwise directed in writing by Architect. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

G. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 days if Contractor disagrees with response.

H. Contractor's Expense for RFI's: Architect will review and respond to legitimate RFI's at no additional cost to the Contractor. RFI's determined by the Architect to be flagrant or unnecessary will have the expense for the Architect's time paid by the Owner with the amount being deducted from the Contract Sum. The expense will be based on an hourly rate in accordance with the Architect's standard hourly rate schedule in effect at the time the work is performed with a minimum of one hour for each flagrant or unnecessary RFI.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

(REQUEST FOR INFORMATION form included on the following page)

Request for Information

Corporate Headquarters
7535 N. Palm Ave. #201
Fresno, CA 93711

559.437.0887 T
559.438.7554 F
teterae.com

Project:
Project Title
TETER Project No.
123 Street Address
City, State, Zip

From:
Name
Company Name

To:
Name
Title or Department
TETER
123 Street Address
City, State, Zip

Client Project No.

DSA File No.

DSA Appl No.

Drawing:_____

Detail No._____

Specification:_____

Addendum:_____

Date:

Request for Information No. _____

☐ Deviation from Contract Docs

☐ Correction of Non-Compliant Work

Respond by:

Priority
(Low) 1 2 3 4 5 (High)

Subject: _____

Information Requested:

Contractor's Recommendation:

Probable Cost Effect: _____ Probable Time Effect: _____

Architect's Response:

Disclaimer
The work shall be carried out in accordance with the above supplemental instructions pursuant the Contract Documents, without change in the Contract Sum or Contract Time. Proceeding with the Work, according to these instructions, indicates your acknowledgement that there will be no change in the Contract Sum or Contract Time. If the Contractor considers that this response requires a change in the Contract Sum or Contract Time, the Contractor shall not proceed with this Work and shall promptly submit an item proposal.

SECTION 012900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections:

1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
3. Division 01 Section "Submittal Procedures" for administrative requirements governing the preparation and submittal of the submittal schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the Schedule of Values to Architect at earliest possible date but no later than 7 days before the date scheduled for submittal of initial Applications for Payment.

    a. Architect will not act on any RFI's, Post-Bid Substitutions, and/or changes to the project scope, cost, or schedule until 7 days following the submission of the Schedule of Values.

3. Subschedules for Phased Work: Where the Work is separated into phases or increments requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values correlated with each element.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

        1) Labor.
        2) Materials.
        3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of 5 percent of Contract Sum.

a. Include separate line items under Contractor and principal subcontracts for project closeout requirements in an amount totaling 5 percent of the Contract Sum and subcontract amount.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment application shall be as indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

1. If dates and periods are not indicated in the Agreement between Owner and Contractor at time of bidding, the date for Application for Payment shall be established by the Owner to correspond with the Owner’s administrative procedures in order to allow for processing and approval of Application for Payment. The period of construction work covered by each Application for Payment shall be one month.
2. Submit draft copy of Application for Payment 7 days prior to due date for review by Architect.

C. Application for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Materials previously stored and included in previous Applications for Payment.
    b. Work completed for this Application utilizing previously stored materials.
    c. Additional materials stored with this Application.
    d. Total materials remaining stored, including materials with this Application.

F. Transmittal: Submit 6 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.

3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Submittal schedule (preliminary if not final).
5. List of Contractor's staff assignments.
6. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
7. Initial progress report.
8. Report of preconstruction conference.

I. Application for Payment at Substantial Completion: After issuance of the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portions of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Updated final statement, accounting for final changes to the Contract Sum.
3. Evidence that claims have been settled.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013113

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Coordination drawings.

B. Related Sections:

1. Division 01 Section "Project Meetings" for project meetings.
2. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
3. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.
5. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 SUBMITTALS

A. List of Key Personnel Names: Within 15 calendar days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

B. Coordination Drawings:

1. Initial Submittal: Submit digital PDF document of each coordination drawing for each condition where Coordination Drawings are required.
2. Project Closeout:

    a. Submit 3 printed “Record” copies of each coordination drawing for each condition where Coordination Drawings are required.
    b. Submit “Record” electronic coordination drawing files.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity. Coordination Drawings shall include the work of multiple trades on the same drawing. Where applicable, provide coordination drawings for the following:

1. Utility connections for building services.
2. Utility connections for equipment.
3. The crossing of multiple underground utilities.
4. Equipment installations and required service space with adjacent construction.
5. Work above ceilings including but not limited to lighting fixtures, ductwork, fire sprinkler piping, mechanical equipment, and building structure.

B. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
1. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
2. Coordinate the addition of trade-specific information to the coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
3. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
4. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
5. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
6. Indicate required installation sequences.
7. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
8. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

9. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
d. Location of pull boxes and junction boxes, dimensioned from column center lines.

10. Fire-Protection System: Show the following:

a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

C. Coordination Drawings: Where Project conditions necessitate coordination drawings, provide coordination drawings as follows:

1. Overhead Work and Work Above Finished Ceilings: Indicate framing for support of ceiling and wall systems, conduit and piping runs, plumbing, mechanical, and electrical equipment, and related Work. Locate components to accommodate layout of light fixtures indicated on Drawings. Show the work of each trade including, but not limited to, pipe runs, mechanical ductwork, cable trays, conduit runs, and bracing and supports.

a. Indicate locations of all dampers, valves, cleanouts and other devices requiring human access for maintenance and repair. Where access panels are required, show locations and indicate size.
b. Show the height above finish floor each item, demonstrating sufficient space for installation and maintenance. Indicate sizes of ducts, piping and similar items.
c. Layout of work shall be done in such a manner to avoid conflicts between the work of different trades, finish ceiling heights, soffits, light fixtures or other finish work at ceilings and soffits.
d. Should unavoidable conflicts occur that affect finish ceiling and soffit heights, methods of installations, methods of construction or means of accessibility, the contractor shall clearly identify each location for review by the Architect.

2. Equipment Rooms and Outdoor Service Yards: Show work above and below grade including mechanical, plumbing, fire protection, fire alarm, and electrical equipment, and related supports, accessories, and utility connections. Include the following information:

a. Equipment: Show equipment and locations, utility connections, and working and service clearances.
b. Utilities: Show above and below grade utilities; indicate heights and below grade elevations, sizes of piping and conduit, dimensions between utilities and between utilities and other obstructions including concrete footings for other work. Show locations of all shut-off and isolation valves, cleanouts, filters, and other devices requiring human access for maintenance and repair.
c. Enclosures: Show limits of enclosure including walls, doors, fences, and gates; confirm door and gate access width for equipment.
d. Dimensions: Indicate dimensions as appropriate to insure adequate clearance will be provided for installation, service, and operation of

equipment; include horizontal and vertical dimensions between utilities to insure clearance for installation of utilities. Include vertical dimension(s) of equipment and distances to overhead obstructions where applicable.

3. Roof Mounted Equipment: Show equipment that will be located on the roof, include the following:

    a. Equipment locations and horizontal distances between equipment.
    b. Locations of roof penetrations, sizes of penetrations, and indicate the horizontal distance between penetrations and roof mounted equipment.
    c. Pipe and conduit runs including locations and type(s) of supports.
    d. Distance between all roof mounted equipment and roof drainage features. Equipment shall be located so as to not obstruct roof drainage; provide at least 24 inches between equipment platforms and valleys formed by the intersection of roof planes and crickets.

4. Underground Site Utilities and Utilities Below Slabs on Grade within Building Areas: Where underground utilities cross other utilities, penetrate footings, underground structures or other obstructions; show the work that will be placed underground; include the following information:

    a. Indicate types and sizes of utility piping and elevations below grade.
    b. Show footings and other underground structures; where unavoidable conflicts occur between underground structures/footings and utilities, indicate depths below grade and clearly identify locations for sleeving for review by Architect.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

D. Coordination Drawing Digital Data Files: Prepare coordination digital data files according to the following requirements:

E. Coordination Drawing Digital Data Files: Submit digital coordination drawing files using PDF format.

1. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

    a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    b. Digital Data Software Program: Drawings are available in PDF format.
    c. Contractor shall execute a data licensing agreement as required by Division 01 Section “Use of Architect’s Electronic files.

F. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not

being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

G. Resolution of conflicts occurring in the Work after Coordination Drawings have been prepared shall be the responsibility of the Contractor. Contractor shall bear all costs associated with resolution of conflicts including additional contract time, architectural and engineering services fees, and loss of use to the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013119
PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for project meetings, including, but not limited to, the following:

1. Preconstruction conferences.
2. Preinstallation conferences.
3. Progress meetings.
4. Project Closeout Conference.

B. Related requirements include but are not limited to the following:

1. Division 01 Sections as applicable to project management.

1.3 PRECONSTRUCTION CONFERENCE

A. Preconstruction Conference: Schedule a preconstruction conference before starting construction at the project site, at a time convenient to the Owner, Project Inspector, and the Architect, but no later than 14 days after execution of the Agreement. Hold the conference at the Project Site or another convenient location. Owner and Architect to conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its superintendent shall attend the conference. Major subcontractors and other concerned parties shall be invited to attend the conference, but attendance is not mandatory. Participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress, including but not limited to the following:

1. Tentative construction schedule.
2. Critical work sequencing and long-lead items.
3. Designation of key personnel and their duties.
4. Lines of communication.
5. Procedures for processing field decisions and Change Orders.

6. Procedures for processing Applications for Payment.
7. Procedures for RFI's.
8. Procedures for testing and inspection.
9. Submittal procedures.
10. Sustainability requirements including construction waste management and disposal.
11. Preparation of record documents.
12. Use of the premises.
13. Work restrictions and working hours.
14. Temporary facilities and controls.
15. Parking availability.
16. Office, work, and storage areas.
17. Equipment deliveries and priorities.
18. Safety procedures and first aid.
19. Security.
20. Housekeeping.
21. Owner's alcohol, drug and tobacco policy.

D. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Project Inspector, and Architect, within three days of the meeting.

1.4 PREINSTALLATION CONFERENCES

A. Preinstallation Conferences: Conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction.

B. Attendees: Installers and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Owner, Project Inspector, and Architect of scheduled meeting dates.

C. Agenda: Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for the following:

1. Contract Documents.
2. Options.
3. Related RFI's, Proposal Requests, and Change Orders.
4. Purchases.
5. Deliveries.
6. Submittals.
7. Sustainability requirements.
8. Possible conflicts.
9. Compatibility problems.
10. Time schedules.
11. Weather limitations.
12. Manufacturer's written instructions.
13. Warranty requirements.
14. Compatibility of materials.

15. Acceptability of substrates.
16. Temporary facilities.
17. Space and access limitations.
18. Regulations of authorities having jurisdiction.
19. Safety.
20. Testing and inspecting requirements.
21. Required performance results.
22. Recording requirements.
23. Protection.
24. Record significant conference discussions, agreements, disagreements, including corrective measures and actions.
25. Promptly distribute minutes of the meeting to each party present and to other parties requiring information, including the Owner and the Architect.
26. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

D. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Project Inspector, and Architect, within three days of the meeting.

1.5 PROGRESS MEETINGS

A. Progress Meetings: Conduct progress meetings at the Project Site at regular intervals to be established by the Architect, Inspector of Record, Contractor, and Owner.

1. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project. Review proposed percentages of work completed for current months progress payment.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

2. Review the present and future needs of each entity present, including the following:

    a. Interface requirements.
    b. Sequence of operation.
    c. Status of submittals.
    d. Status of Sustainability documentation.
    e. Deliveries.
    f. Off-site fabrication.
    g. Access.
    h. Site utilization.
    i. Temporary facilities and services.
    j. Status of correction of deficient items.
    k. Field observations.
    l. Status of RFI's, Proposal Requests, and Change Orders.
    m. Progress cleaning.
    n. Quality and work standards.
    o. Documentation of information for payment requests.
    p. Request for Information

D. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Project Inspector, and Architect, within three days of the meeting.

E. Schedule Updating: Revise the Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule to the Owner, the Architect, and all other parties involved in the project. Failure to revise and keep current the Contractor's construction schedule may be grounds for returning Application for Payment unreviewed.

1.6 PROJECT CLOSEOUT CONFERENCE

A. Project Closeout Conference: Conduct a project closeout conference, at a time convenient to Owner and Architect, but not less than 90 days prior to the scheduled date of Substantial Completion. Conduct the conference to review requirements and responsibilities related to Project closeout.

B. Attendees: Authorized representatives of Owner, Architect and their consultants; Contractor and its superintendent. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

1. Preparation of record documents.
2. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
3. Submittal of written warranties.
4. Requirements for completing Sustainability documentation.
5. Requirements for preparing operations and maintenance data.

6. Requirements for delivery of material samples, attic stock, and spare parts.
7. Requirements for demonstration and training.
8. Preparation of Contractor's punch list.
9. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
10. Submittal procedures.
11. Responsibility for removing temporary facilities and controls.

D. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Project Inspector, and Architect, within three days of the meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Special reports.

B. Related Sections include but are not limited to the following:

1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
2. Division 01 Section "Quality and Testing Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Milestone: An activity, which occurs in an instant and thus has no time duration, a key or critical point in time for reference or measurement.

1.4 SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit electronic copy of schedule labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. Construction Schedule Updating Reports: Submit with Applications for Payment.

E. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Discuss constraints, including phasing, separate increments, work stages, area separations, interim milestones, and partial Owner occupancy.
2. Review delivery dates for Owner-furnished products.
3. Review schedule for work of Owner's separate contracts.
4. Review submittal requirements and procedures.
5. Review time required for review of submittals and resubmittals.
6. Review requirements for tests and inspections by independent testing and inspecting agencies.

7. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
8. Review and finalize list of construction activities to be included in schedule.
9. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules with performance of construction activities and with scheduling of separate contractors.

B. Coordinate Contractor's construction schedule with the submittal schedule and other required schedules.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Completion: Indicate completion in advance of date established for completion, and allow time for Architect's administrative procedures necessary for certification of completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.

2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.

    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Submittals.
    b. Purchases.
    c. Mockups.
    d. Fabrication.
    e. Sample testing.
    f. Deliveries.
    g. Installation.
    h. Tests and inspections.
    i. Adjusting.
    j. Curing.
    k. Startup and placement into final use and operation.

7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis to demonstrate the effect of the proposed change on the overall project schedule.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.

    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by Owner that may affect or be affected by Contractor's activities.
    i. Testing
    j. Commissioning.
    k. Punch list and final completion.
    l. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.

7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.3 SPECIAL REPORTS

A. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At progress meetings, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, Project Inspector, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 013233

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.

B. Related Sections:

1. Division 02 Section "Selective Demolition" for photographic documentation before building demolition operations commence.
2. Division 31 Section "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 SUBMITTALS

A. Digital Photographs: Submit image files at monthly intervals coinciding with the cutoff date associated with each Application for Payment.

1. Submit photos by uploading to Project FTP site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description:

a. Date photograph was taken.
b. Description of location, vantage point, and direction.
c. Unique sequential identifier keyed to accompanying key plan.

3. Key Plan: Include key plan of Project site and/or building(s) indicating location and direction of each photograph or group of photographs. Include same information as corresponding photographic documentation.

1.4 PHOTOGRAPHIC FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. File Names: Name media files with location or area photograph was taken, date, and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.

B. Key Plan: Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and adjacent areas, including existing items to remain during construction, from different vantage points, as necessary to record preconstruction conditions.

1. Take additional photographs as needed to record settlement or cracking of existing adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take photographs to record construction progress at not greater than bi-weekly intervals with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
3. Cost for multiple resubmittals.

B. Related Sections:

1. Division 01 Section “Payment Procedures” for submitting Applications for Payment and the schedule of values.
2. Division 01 Section "Project Management and Coordination" for submitting coordination drawings.
3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Division 01 Section "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and final completion construction photographs.
5. Division 01 Section "Quality and Testing Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
6. Division 01 Section "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
7. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
8. Division 01 Section "Project Record Drawings" for submitting record Drawings.
9. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit as a submittal, a list of submittals arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates.

Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Name of subcontractor.
    d. Description of the Work covered.
    e. Scheduled date for Architect's final release or approval.
    f. Scheduled dates for purchasing.
    g. Scheduled date of fabrication.
    h. Scheduled dates for installation.
    i. Activity or event number.

1.4 SUBMITTAL FORMAT AND PROCEDURES

A. General: Prepare and submit submittals required by individual Specification Sections.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.
2. Architect will not review submittals received from sources other than the Contractor.

B. Electronic Digital Submittals: Prepare submittals as PDF package unless otherwise indicated, incorporate complete information into each PDF file, name PDF file with submittal number, and transmit submittal package to Architect via email.

1. Paper Submittals: Where paper submittals are requested, necessary, or required in lieu of electronic submittals, prepare submittals in paper form and deliver to Architect. Transmit each paper submittal using transmittal form. Comply with the following:

    a. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.

b. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
c. Number of Copies: Submit not less than three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
d. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using transmittal form.

C. Submittal Cover Page Information: Include the following information on the submittal cover page for each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
8. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
9. Drawing number and detail references, as appropriate.
10. Indication of full or partial submittal.
11. Location(s) where product is to be installed, as appropriate.
12. Other necessary identification.
13. Remarks.
14. Signature of transmitter.
15. Contractor’s review/approval stamp of size required by contractor, approximately 3 inches by 3 inches, on or beside title block to record Contractor's review and approval.
16. Space for Architect’s review stamp of not less than 4 inches wide by 3-1/2 inches high on or beside title block to record Architect’s review stamp and action taken by Architect.

D. Product Options:

1. Clearly identify options requiring selection by Architect.
2. Clearly identify product options required to comply with the Contract Documents.

E. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

F. Field Conditions: Indicate field conditions where applicable to the work associated with the submittal.

G. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate timing of submitting submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review related submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

H. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 14 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 14 calendar days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 calendar days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 14 calendar days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

    a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Retain complete copies of submittals on Project site. Use only final submittals that are marked with acceptable notation from Architect's action stamp.

1.5 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.

e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Drawing Sheet Size: Except for templates, patterns, and similar full-size Drawings, prepare Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in PDF format unless otherwise indicated.

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

a. Project name and submittal number.
b. Generic description of Sample.
c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Submit samples in PDF format unless physical samples are required.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of

repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three (3) sets of Samples. Architect will retain two (2) Sample sets; remainder will be returned.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.6 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file(s) of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.7 CONTRACTOR'S REVIEW

A. Contractor's Review of Submittals: Contractor shall review each submittal and check for completeness, coordination with other Work of the Contract, and compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.
2. Contractor's approval shall certify the following actions by the Contractor:

a. Field measurements have been determined, verified, and indicated on submittal.
b. Field conditions have been verified and coordinated with Work associated with the submittal.
c. The Work associated with the submittal is in conformance with the Contract Documents.
d. Work being performed by various subcontractors and trades is coordinated with Work associated with the submittal including work being performed by others for the Owner.
e. Deviations from the Contract Documents are identified and notes.

1.8 ARCHITECT'S REVIEW

A. Architect's Review and Action: Architect will review each submittal, indicate corrections or revisions required, mark with an action stamp indicating one of the following actions, and return it.

1. Reviewed: Final unrestricted release, work may proceed, provided it complies with the Contract Documents.
2. Furnish as Corrected: Final but restricted release, work may proceed, provided written confirmation is delivered to Architect by Contractor that installed work complied with notations and corrections on submittal and with Contract Documents.

3. Revise and Resubmit: Returned for resubmittal, do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain an acceptable action marking. Do not allow submittals with this marking (or unmarked submittals where a marking is required) to be used in connection with performance of the Work.
4. Rejected: Submittal content varies from the Contract Documents and is not acceptable for use on the Project, do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain an acceptable action marking. Do not allow submittals with this marking (or unmarked submittals where a marking is required) to be used in connection with performance of the Work.

B. Non-conforming Submittals: The following are considered non-confirming submittals and will not be reviewed by the Architect.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.
2. Architect will not review submittals received from sources other than the Contractor.
3. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
4. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

C. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

1.9 COST FOR MULTIPLE RESUBMITTALS

A. Contractor’s initial submittal and one resubmittal are included in the Architect’s Construction Administration services to the Owner. Architect’s services for review of subsequent resubmittals will be charged to the Owner at the Architect’s current billing rate, and the Owner will deduct the charges from the Contract Amount by a change order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014000

QUALITY AND TESTING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control including but not limited to the following:

1. General quality requirements.
2. Reports and documents.
3. Contractor’s responsibilities for testing and inspections.
4. Project Inspector.
5. Testing Agency.
6. Governing agency testing and inspection requirements.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Requirements:

1. Divisions 02 through 33 Sections for specific test and inspection requirements.

D. DSA Testing and Inspection Requirements for School Construction: The following requirements are per the Division of the State Architect (DSA); requirements indicated below may be repeated elsewhere in this Section or in other Sections of the Project Manual, where conflicts occur, the most stringent condition shall apply.

1. Tests:

a. The owner will select an independent testing laboratory, approved by DSA, to conduct the tests. Selection of the material required to be tests shall be by the laboratory or the Owner's representative and not by the Contractor.
b. The Contractor shall notify the Owner's representative a sufficient time in advance of the manufacture of material to be supplied by him under the Contract Documents, which must by terms of the Contract be tested, in order that the Owner may arrange for the testing of same at the source of supply.
c. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.
d. The Owner will pay testing laboratory costs for all tests and inspections, but may be reimbursed by the Contractor for such costs under the Contract documents.

2. Tests Reports: One copy of all test reports shall be forwarded to the Division of the State Architect by the testing agency. Such reports shall include all the tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations as required shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of Title 24 and with the approved specifications. Test reports shall show the specified design strength. They shall also state defiantly whether or not the material or materials tested comply with requirements.
3. Verification of Test Reports: Each testing agency shall submit to the Division of the State Architect a verified report in duplicate covering all the tests which are required to be made by that agency during the progress of the project. Such report shall be furnished each time that work on the project is suspended, covering the tests up to that time, and at the completion of the project, covering all tests.
4. Inspection by the Owner:

a. The Owner and his representatives shall at all times have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
b. The Owner shall have the right to reject materials and workmanship which are defective, or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the Owner. If the Contractor does no correct such rejected work within a reasonable time, fixed by written notice, the Owner may correct same and charge expense to the Contractor.
c. Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire work to make an examination of the work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any respect due to the fault of the Contractor or his subcontractor, he shall defray all expenses of such examinations and of satisfactory reconstruction. If however, such work is found to meet the requirements of the Contract, the additional cost

of labor and material necessarily involved in the examination and replacement shall be allowed the Contractor.

5. Owner's Project Inspector:

   a. A Project Inspector employed by the Owner, and approved by DSA, in accordance with the requirements of the California Code of Regulations, Title 24 will be assigned to the work. The Project Inspector's duties are defined in Title 24, Part I, Sec. 4-342.
   b. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Project Inspector. The Project Inspector shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Project Inspector reasonable facilities for obtaining such information as may be necessary to keep the Project Inspector fully informed respecting the progress and manner of the work and the character of materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this contract.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

   1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Full-size physical assemblies that are constructed either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

   1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
   2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements or as indicated in-place portions of permanent construction, consisting of multiple products, assemblies, and

subassemblies, with cutaways enabling inspection of concealed portions of the Work.

a. Include each system, assembly, component, and part of the exterior wall and/or roof to be constructed for the Project. Colors of components shall be those selected by the Architect for use in the Project.

3. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
4. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

H. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

I. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

J. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 INFORMATIONAL SUBMITTALS

A. Reports: Prepare and submit certified written reports and documents as specified.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Reports shall be prepared by the person performing the testing and inspecting. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Governing Agency Verified Reports: Complete and submit Verified Reports as required by the Division of the State Architect and the California Administrative Code, Section 4-336. Reports are required to be completed by Architect, Architect's consulting Engineers, Owner's Project Inspector, Contractor, and Testing Agency.

1. Form:

a. DSA form DSA-6C for Contractor.
b. DSA form DSA-6PI for Project Inspector.
c. DSA form DSA-6A/E for Architect and Architect's consulting Engineers.

C. Manufacturer's Technical Representative's Field Reports: Provide written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Reports shall be prepared by Manufacturer's technical representative performing the testing and inspecting. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

D. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Reports shall be prepared by Factory-authorized service representative performing the testing and inspecting. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally licensed to practice in the state where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

K. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings or as specified in individual specification Sections. Coordinate installation of exterior envelope materials and products for which mockups are required in individual

Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.

1. Coordinate construction of the mockup to allow observation of air barrier installation, flashings, air barrier integration with fenestration systems, and other portions of the building air/moisture barrier and drainage assemblies, prior to installation of veneer, cladding elements, and other components that will obscure the work.

1.9 PROJECT INSPECTOR

A. General: Owner will employ a Project Inspector for continuous inspection of the Work. Project Inspector shall be acceptable to Architect and approved by the Division of the State Architect.

1. Project Inspector shall act under the direction of the Architect and shall be subject to supervision by a representative of the Division of the State Architect.

B. Qualifications for Project Inspector: Qualifications for the Project Inspector shall be as stated in the California Code of Regulations, Title 24, Part 1, California Administrative Code, Section 4-333.1. Project Inspector shall be DSA certified under one of the following classes:

1. Class 1: May inspect any project.
2. Class 2: May inspect any project except a project containing one or more new large structures with a primary lateral load resisting system of steel, masonry, or concrete.
3. Class 3: May inspect projects containing alterations to approved buildings, site placement of relocatable buildings, and construction of minor structures.
4. Class 4: May inspect site placement of relocatable buildings and associated site work.

C. Duties of the Project Inspector: Duties of the Project Inspector shall be as stated in the California Code of Regulations, Title 24, Part 1, California Administrative Code, Sections 4-333(b) and 4-342, and include the following:

1. Provide continuous inspection of the work.
2. Maintain files and records of approved plans and specifications including addenda and change orders.
3. Prepare semi-monthly reports of the progress of the work and submit copies to the Architect and the Division of the State Architect.
4. Notify the Division of the State Architect at the following times:

    a. At the start of construction of the project or restart of construction if work has suspended for a period of 2 or more weeks.
    b. At least 48 hours in advance of the time when foundation trenches will be complete, ready for footing forms.
    c. At least 48 hours in advance of the first placement of foundation concrete and 24 hours in advance of any subsequent or significant concrete placement.

d. When all work on the project has been suspended for a period of more than 2 weeks.

5. Prepare and maintain records of certain phases of construction including but not limited to the following:

   a. Concrete placing operations. Show date and time of placing concrete and the time and date of removal of forms in each portion of the structure.
   b. Welding operations. The record shall include identification marks of welders, lists of defective welds, and manner of correction of defects.

6. Notify the Contractor, in writing, of any deviations from the approved construction documents.
7. Prepare and submit Project Inspector’s Verified Report as required by DSA.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to conduct tests and inspections required by authorities having jurisdiction. Testing agency shall be acceptable to Architect and the Division of the State Architect. Requirements for tests and testing agency shall be as stated in the California Code of Regulations, Title 24, Part 1, California Administrative Code, Section 4-335.

   1. Costs for testing agency services will be paid by the Owner.
   2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be paid by the Owner and the amount will be deducted from the Contract Sum by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

   3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
7. Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

    a. Access to the Work.
    b. Incidental labor and facilities necessary to facilitate tests and inspections.
    c. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
    d. Facilities for storage and field curing of test samples.
    e. Preliminary design mix proposed for use for material mixes that require control by testing agency.
    f. Security and protection for samples and for testing and inspecting equipment at Project site.

8. Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

    a. Schedule times for tests, inspections, obtaining samples, and similar activities.

9. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

    a. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
    b. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct tests and inspections.

4. Prepare written reports of tests and inspections, state in each report whether tested and inspected Work complies with or deviates from requirements, and submit reports of each test, inspection, and similar quality-control service to Architect, Division of the State Architect, and Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

1.11 TESTS AND INSPECTIONS

A. Structural Tests and Inspections shall be as specified in Division 02 through 33 Sections for specific materials and as required by form DSA-103 which lists tests and inspections required by DSA as applicable to Project conditions.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 014200

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract. Architect’s approval does not release the Contractor from the responsibility to fulfill Contract requirements.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
2. ICC - International Code Council; www.iccsafe.org.
3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.

7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. DSA; Division of the State Architect.
7. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
8. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Division 01 Section "Summary of Work" for work restrictions and limitations on utility interruptions.
2. Division 01 Section "Multiple Contract Summary" for responsibilities for temporary facilities and controls for projects utilizing multiple contracts for separate increment.
3. Division 01 Section “Fire Safety During Construction” for fire safety requirements during construction.
4. Division 07 Sections as applicable to roofing for temporary roofing requirements.
5. Division 31 Sections applicable to site clearing, earthwork, and trenching for temporary erosion and sedimentation control.

1.3 USE CHARGES

A. General: Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to Owner, Architect, testing agencies, and authorities having jurisdiction.

B. Water Service from Existing System: Water from Owner's existing water system is available for use; provide connections and extensions of services as required for construction operations.

1. Provide temporary water meter and pay use charges for water used by all entities for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use; provide connections and extensions of services as required

1. Provide temporary electric power meter and pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 SUBMITTALS

A. Erosion and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Comply with submittal requirements of Division 31 through 33 Sections as applicable for temporary erosion and sedimentation control plans.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 REGULATORY REQUIREMENTS

A. Regulatory Requirements: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. California Code of Regulations, Title 24, California Code requirements as applicable to the project.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, fire department, and rescue squad rules.
5. Environmental protection regulations.
6. Regional Air Pollution Control District permits and requirements.
7. California Department of Water Resources, Stormwater General Permit for projects with site work area greater than one acre.
8. Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1.7 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Materials for temporary facilities shall be acceptable to Architect, Owner, and Authorities having Jurisdiction (AHJ), shall be appropriate for intended use, and shall comply with governing codes and regulations.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts. Provide concrete or galvanized-steel bases for supporting posts.

C. Fencing Windscreen: Polyester fabric scrim with grommets for attachment to chain link fence, size and color as acceptable to, or required by, authorities having jurisdiction.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

2.2 TEMPORARY FIELD OFFICE FACILITIES

A. Field Offices, General: Prefabricated or mobile units having weatherproof exteriors, lockable doors and windows, and with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Contractor’s Field Office: Of sufficient size to accommodate needs of Contractor, Owner, Architect, construction personnel office activities, and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture necessary for use and storage of Project documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room or area of sufficient size to accommodate meetings of 10 individuals; furnish with conference table, chairs, and 4-foot square tack and marker boards.
3. Electrical power service, 120-VAC, with no fewer than one duplex receptacle on each wall.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 78 deg F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

6. Communication Service and Equipment: Equip field office with phone and internet services and equipment adequate for project conditions and for use by Contractor, Architect, and Owner to access Project electronic documents and maintain electronic communications.

    a. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
    b. Equip office with not less than the following:

        1) Desktop computer with capabilities compatible with Architect's requirements. Provide external hard drive backup.
        2) Printer/Copier/Scanner: Single or multiple units as needed to accommodate color printing, photocopying, and scanning.

C. Project Inspector's Field Office: Contractor shall provide temporary office facilities for the Owner's Project Inspector. Temporary facilities shall be of sufficient size to accommodate the needs of the Project Inspector and associated project records. Project Inspector facilities shall be provided with its own lockable exterior access, if interconnected with Contractor's facilities, a lockable door, controlled from the Project Inspector's side, shall be provided between the spaces. Furnish and equip office as follows:

1. Plan/layout table, 30 by 72 inches minimum.
2. File cabinets having a total capacity of not less than eight (8) legal size file drawers.
3. Open shelving/book case, 48 inches minimum in total shelving width.
4. Desk and Chair.
5. Plan rack.
6. Internet service.
7. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 78 deg F.
8. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.3 TEMPORARY STORAGE FACILITIES

A. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from buildings.

2.4 TEMPORARY SANITARY FACILITIES

A. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use by construction and related administrative personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. Temporary toilets shall be self-contained, single-occupant units of the chemical, aerated recirculation type; provide units properly vented and fully

enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Use of Owner's sanitary facilities is not permitted.

1. Accessibility Requirements: Sanitary facilities serving support facilities such as offices, meeting rooms, plan rooms, and serving personnel not directly associated with the actual processes of construction shall be accessible for a person using a wheelchair and shall comply with CBC Section 11B-213 (Ref. CBC 11B-201.4).

2.5 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section "Closeout Procedures."

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

3.2 INSTALLATION, GENERAL

A. Locate facilities at locations directed by the Owner where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITIES AND BUILDING HVAC

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to private or municipal system as indicated on Drawings and as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

1. Existing Water Service: Where connection to Owner’s existing water service is available and allowed, clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Where temporary power service is required, install electric power service overhead unless otherwise indicated.
2. Where Owner’s existing power service is available, connect temporary service to Owner's existing power source, as directed by Owner, maintain equipment in a condition acceptable to Owner.

F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

G. Telephone Service: Provide temporary telephone service of sufficient size, capacity, and power characteristics required for construction operations in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment for each field office.

1. Post a list of important telephone numbers at a conspicuous location, include the following:

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Locate storage containers, and other temporary construction and support facilities for easy access in the areas designated and approved by the Architect and Owner. Comply with the following:

1. Do not locate temporary offices, shops, and sheds within 30 feet of building lines.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Parking areas for construction personnel shall be at location(s) as directed by Owner.

E. Storage and Staging: Use designated areas of Project site for storage and staging needs.

F. Dewatering: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Project Address Sign: Provide temporary project address sign as required by Authority having Jurisdiction.
3. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

4. Maintain and touchup signs so they are legible at all times.

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations.

1. Comply with requirements of the following:

    a. Authorities having jurisdiction.
    b. Division 01 Section "Execution" for progress cleaning.
    c. Division 01 Section "Construction Waste Management and Disposal."

2. Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during

normal weather or 3 days when the temperature is expected to rise above 80 deg F. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Elevator Use: Use of elevators is not permitted.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

M. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 01 Section "Summary of Work."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements erosion and sedimentation-control Drawings, EPA Construction General Permit, or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree or plant- protection zones.
2. Inspect, repair, and maintain erosion and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.

4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Security Enclosure Fence and Lockup: Before construction operations begin, furnish and install project enclosure fence in a manner that will prevent people and animals from easily entering the site except by entrance gates. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and protection program for personnel at Project site. Review needs with local fire department and establish

procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.6 MOISTURE AND MOLD CONTROL

A. General: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings

beginning at time of exposure and continuing daily for 48hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

c. Remove materials that cannot be completely restored to their manufactured moisture level within 48hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

SECTION 015116

FIRE SAFETY DURING CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for fire safety during construction and demolition.

B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for additional facilities, requirements, and procedures required during construction.

1.3 SUBMITTALS

A. Site Safety Plan: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of the Site Safety Plan.

1.4 REGULATORY REQUIREMENTS

A. Regulatory Requirements: Comply with applicable provisions of the following:

1. NFPA 241.
2. California Fire Code, 2022 Edition, Chapter 33 “Fire Safety During Construction and Demolition” and the 2022 Editions of the following California Codes as Referenced by the California Fire Code:

a. California Building Code (CBC).
b. California Mechanical Code (CMC).
c. California Plumbing Code (CPC).
d. California Electrical Code (CEC).

B. Responsibility for Fire Protection (CFC 3303)

1. Program Development and Maintenance: The Contractor shall be responsible for the development, implementation and maintenance of an approved written site safety plan establishing a fire prevention program at the project site applicable

throughout all phases of the construction, repair, alteration, or demolition work. The plan shall address the requirements of CFC Section 3303.1

2. Site Safety Director: The Contractor shall designate a person to be the Site Safety Director. The Site Safety Director shall be responsible for ensuring compliance with the site safety plan. The Site Safety Director shall have the authority to enforce the provisions of the California Fire Code, Chapter 33, and other provisions as necessary to secure the intent of the California Fire Code, Chapter 33. Where guard service is provided in accordance with NFPA 241, the Site Safety Director shall be responsible for the guard service.
3. Daily Fire Safety Inspection: The Site Safety Inspector shall be responsible for completion of a daily fire safety inspection at the project site. Each day, all building and outdoor areas shall be inspected to ensure compliance with the inspection list in California Fire Code Section 3303.3. The results of each inspection shall be documented and maintained on-site util a certificate of occupancy has been issued. Documentation shall be immediately available on-site for presentation to the fire code official upon request.

    a. Qualifications: Site Safety Directors shall acquire training specific to their roles and responsibilities. Upon request, the training and qualifications of the Site Safety Director shall be submitted to the fire code official for approval.

4. Training: Training of fire watch and other responsible personnel in the use of fire protection equipment shall be the responsibility of the Site Safety Director. Records of training shall be kept and made a part of the written plan for the Site Safety Plan.
5. Fire Protection Devices: The Site Safety Director shall ensure that all fire protection equipment is maintained and serviced in accordance with the California Fire Code. Fire protection equipment shall be inspected in accordance with the fire protection program.
6. Hot Work Operations: The Site Safety Director shall ensure hot work operations and permit procedures are in accordance with the California Fire Code, Chapter 35.
7. Impairment of Fire Protection Systems: The Site Safety Director shall ensure impairments to any fire protection system are in accordance with California Fire Code, Section 901.

    a. Smoke detectors and smoke alarms located in an area where airborne construction dust is expected shall be covered to prevent exposure to dust or shall be temporarily removed. Smoke detectors and alarms that were removed shall be replaced upon conclusion of dust producing work. Smoke detectors and smoke alarms that were covered shall be inspected and cleaned, as necessary, upon conclusion of dust producing work.

8. Temporary Covering of Fire Protection Devices: Coverings placed on or over fire protection devices to protect them from damage during construction processes shall be immediately removed upon the completion of the construction processes in the room or area in which the devices are installed.

C. Temporary Heating Equipment (CFC 3304):

1. Listing: Temporary heating devices shall be listed and labeled. Installation, maintenance and use of temporary heating devices shall be in accordance with the terms of the listing and the manufacturer's directions.
2. LP-Gas Heaters: Fuel supplies for liquified petroleum gas fired heaters shall comply with California Fire Code, Chapter 61 Liquefied Petroleum Gases, and the California Mechanical Code.
3. Refueling: Refueling operations for liquid fueled equipment or appliances shall be conducted in accordance with the California Fire Code, Section 5705. The equipment or appliance shall be allowed to cool prior to refueling.
4. Installation: Clearance to combustibles from temporary heating devices shall be maintained in accordance with the labeled equipment. When in operation, temporary heating devices shall be fixed in place and protected from damage, dislodgement or overturning in accordance with the manufacturer's instructions.
5. Supervision: The use of temporary heating devices shall be supervised and maintained only by competent personnel.
6. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

D. Precautions Against Fire (CFC 3305):

1. Smoking: Smoking shall not be allowed on the project site.
2. Combustible Debris, Rubbish and Waste:

    a. Combustible debris, rubbish and waste shall not be accumulated within buildings.
    b. Combustible debris, rubbish and waste material shall be removed from buildings at the end of each shift of work.
    c. Rubbish containers with a capacity exceeding 5.33 cubic feet (40 gallons) used for temporary storage of combustible debris, rubbish and waste materials, shall have tight fitting or self-closing lids. Such containers shall be constructed entirely of materials that are non-combustible or materials that meet a peak rate of heat release not exceeding 300 kW/m^2 when tested in accordance with ASTM E 1354 at an incident heat flux of 50 kW/m^2 in the horizontal orientation.
    d. Materials susceptible to spontaneous ignition, such as oily rags, shall be stored in a listed disposal container.

3. Burning: Burning of materials shall not be allowed on the project site.
4. Fire Watch: Where required by the fire code official or the Site Safety Plan established in accordance with California Fire Code Section 3303.1, a fire watch shall be provided for building demolition and for building construction.

    a. Fire Watch During Construction: A fire watch shall be provided during non-working hours for new construction that exceeds 40 feet in height above the lowest adjacent grade at any point along the building perimeter, for new multi-story construction with aggregate area exceeding 50,000 sf per story or as required by the fire code official.

b. Fire Watch Personnel:

1) Duties: The primary duty of fire watch personnel shall be to perform constant patrols and watch for the occurrence of fire. The combination of fire watch duties and site security duties is acceptable.
2) Training: Personnel shall be trained to serve as an on-site fire watch. Training shall include the use of portable fire extinguishers. Fire extinguishers and fire reporting shall be in accordance with California Fire Code, Section 3310.
3) Means of Notification: Fire watch personnel shall be provided with not fewer than one approved means for notifying the fire department.

c. Fire Watch Location: The fire watch shall include areas specified by the Site Safety Plan established in accordance with California Fire Code Section 3303.
d. Fire Watch Records: Fire watch personnel shall keep a record of all time periods of duty, including the log entry for each time the site was patrolled and each time a structure was entered and inspected. Records shall be made available for review by the fire code official upon request.

5. Cutting and Welding: Welding, cutting, open torches, and other hot work operations and equipment shall comply with California Fire Code Chapter 35 “Welding and Other Hot Work.’
6. Temporary Wiring for Electrical Power: Temporary wiring for electrical power and lighting installations used in connection with the construction, alteration or demolition of buildings, structures, equipment, or similar activities shall comply with the California Electrical Code.

E. Flammable and Combustible Liquids (CFC 3306):

1. Storage of Flammable and Combustible Liquids: Storage of flammable and combustible liquids shall be in accordance with California Fire Code Section 5704.
2. Class I and Class II Liquids: Storage, use, and handling of flammable and combustible liquids at construction sites shall be in accordance with California Fire Code Section 5706.2. Ventilation shall be provided for operations involving the application of materials containing flammable solvents.
3. Housekeeping: Flammable and combustible liquid storage areas shall be maintained clear of combustible vegetation and waste materials. Such storage areas shall not be used for the storage of combustible materials.
4. Precautions Against Fire: Sources of ignition and smoking shall be prohibited in flammable and combustible liquid storage areas. Signs shall be posted in accordance with California Fire Code Section 310.
5. Handling at Point of Final Use: Class I and Class II liquids shall be kept in approved safety containers.
6. Leakage and Spills: Leaking vessels shall be immediately repaired or taken out of service and spills shall be cleaned up and disposed of properly.

F. Flammable Gases (CFC 3307):

1. Storage and Handling: Storage and handling of flammable gasses shall comply with California Fire Code Chapter 58 “Flammable Gases and Flammable Cryogenic Fluids.”
2. Cleaning with Flammable Gases: Flammable gases shall not be used to clean or remove debris from piping open to the atmosphere.

G. Explosive Materials (CFC 3308): Explosive materials shall not be allowed.

H. Portable Generators (CFC 3309): Portable generators used at construction and demolitions sites shall comply with California Fire Code Section 1204

I. Fire Reporting (CFC 3310)

1. Emergency Telephone: Emergency telephone facilities with ready access shall be provided in an approved location at the construction site, or an approved equivalent means of communication shall be provided. The street address of the construction site and the emergency telephone number of the fire department shall be posted adjacent to the telephone. Alternatively, where an equivalent means of communication has been approved, the site address and fire department emergency telephone number shall be posted at the main entrance to the site, in guard shacks, and in the construction site office.

J. Access for Fire Fighting (CFC 3311):

1. Required Access: Approved vehicle access for firefighting shall be provided to all construction or demolition sites. Vehicle access shall be provided to within 100 feet of temporary or permanent fire department connections. Vehicle access shall be provided by either temporary or permanent roads capable of supporting vehicle loading under all weather conditions. Vehicle access shall be maintained until permanent fire apparatus access roads are available.
2. Key Boxes: Key boxes shall be provided as required by California Fire Code Chapter 5 “Fire Service Features.”

K. Means of Egress (CFC 3312):

1. Stairways Required: Where building construction exceeds 40 feet in height above the lowest level of fire department vehicle access, a temporary or permanent stairway shall be provided.
2. Means of Egress: Required means of egress and required accessible means of egress shall be maintained during construction and demolition, remodeling or alterations and additions to any building unless an approved temporary means of egress system is provided.
3. Combustible Materials Storage: Combustible materials associated with construction, demolition, remodeling or alterations to an occupied structure shall not be stored in exits, enclosures for stairs, or exit access corridors serving an occupant load of 30 or more.

L. Water Supply for Fire Protection (CFC 3313):

1. When Required: An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building materials arrive on the site, on concealment of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with California Fire Code Section 3313.2 through 3313.5.

M. Standpipes (CFC 3314):

1. Where Required: In buildings required to have standpipes by California Fire Code Section 905.3.1, not less than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet in height above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to stairways complying with California Fire Code Section 3312.1. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.
2. Buildings Being Demolished: Where a building is being demolished and a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.
3. Detailed Requirements: Standpipes shall be installed in accordance with the provisions of California Fire Code Section 905.

    a. Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes comply with the requirements of California Fire Code Section 905 as to capacity, outlets and materials.

N. Automatic Sprinkler System (CFC 3315):

1. Completion Before Occupancy: In buildings where an automatic sprinkler system is required by the California Fire Code or California Building Code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved, except as provided in California Fire Code Section 105.3.4.
2. Operation of Valves: In buildings where an automatic sprinkler system is provided, operation of sprinkler control valves shall be allowed only by properly authorized personnel and shall be accompanied by notification of duly designated parties. Where the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

O. Portable Fire Extinguishers (CFC 3316):

1. Portable Fire Extinguishers: Structures under construction, alteration or demolition shall be provided with not less than one approved portable fire extinguisher in accordance with the California Fire Code, Section 906 and sized for not less than ordinary hazard, as follows:

   a. At each stairway on all floor levels where combustible materials have accumulated.
   b. In every storage and construction shed.
   c. Additional portable fire extinguishers shall be provided where special hazards exist including, but not limited to, the storage and use of flammable and combustible liquids.

P. Motorized Construction Equipment (CFC 3317):

1. Conditions of Use: Internal combustion powered construction equipment shall be used in accordance with all of the following conditions:

   a. Equipment shall be located so that exhausts do not discharge against combustible material.
   b. Exhausts shall be piped to the outside of the building.
   c. Equipment shall not be refueled while in operation.
   d. Fuel for equipment shall be stored in approved areas outside of the building.

Q. Safeguarding Roofing Operations (CFC 3318):

1. General: Roofing operations utilizing heat producing systems or other ignition sources shall be conducted in accordance with California Fire Code Sections 3318.2 and 3318.3, and Chapter 35.
2. Asphalt and Tar Kettles: Asphalt and tar kettles shall be operated in accordance with the California Fire Code, Section 303.
3. Fire Extinguishers for Roofing Operations: Fire extinguishers shall comply with the California Fire Code, Section 906. There shall be not less than one multi-purpose portable fire extinguisher with a minimum 3-A 40-B:C rating on the roof being covered or repaired.

PART 2 - PRODUCTS

2.1 TEMPORARY EQUIPMENT, GENERAL

A. Temporary Equipment: Temporary equipment shall comply with requirements of Division 01 Section “Temporary Facilities and Controls,” and shall comply with the requirements of this Section.

PART 3 - EXECUTION

A. Fire Safety Observation, Procedures, and Features: Provide fire safety observation activities, procedures, and features as required and in compliance with regulatory requirements.

END OF SECTION

SECTION 015723
STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section This Section includes the following:

1.2 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, and services necessary to: comply with the State of California Construction General Permit Order 2022-0057-DWQ (CGP); implement the Project Storm Water Pollution Prevention Plan (SWPPP); and install and maintain appropriate Best Management Practices (BMP) according to the SWPPP and California Stormwater Quality Association (CASQA) Construction BMP Handbook.
   2. Retain a certified Qualified SWPPP Practitioner (QSP) to implement all Construction Site Monitoring Program (CSMP) elements of the SWPPP, or delegate appropriate roles to the trained Contractor.
   3. Complete and maintain all inspections, sampling, weather monitoring, and recordkeeping required by the CGP, commensurate with a Risk Level 1 SWPPP.
   4. Ensure that all conditions are met for SWPPP termination including, but not limited to: fully stabilizing all disturbed areas of the site; removing temporary BMPs, construction materials, and equipment; cleaning the site of any storm water pollutants within 90-days of completing outdoor construction activities; and notifying Owner and QSD of acceptable termination conditions.
   5. All Contract requirements in Division 00 and 01 specefications.

B. This Section does not include:
   1. The Owner shall retain a Qualified SWPPP Developer (QSD) to prepare the SWPPP document.
   2. The Owner shall submit the Notice of Intent (NOI), SWPPP, Changes of Information (COI), and Annual Reports, Notice of Termination (NOT) to the SWRCB on SMARTS.
   3. The Owner shall complete all required QSD inspections.
   4. The Owner shall pay the NOI application fee and annual renewal fees.
   5. The Owner shall maintain the role of LRP and all responsibilities associated, except where those responsibilities are assigned to the Contractor within these specifications.
   6. The Owner shall complete online digital certification of online reporting on SMARTS

7. After the Contractor has met all conditions for SWPPP termination, Owner shall complete the NOT and obtain approval from SWRCB. If the NOT is returned by SWRCB due to unacceptable site conditions, Contractor shall implement any redresses specified by the SWRCB.
8. Owner shall ensure that the Project design has incorporated all post-construction requirements specified by the CGP, MS4 permittee, and local agency stormwater regulations.

C. Acronyms:
1. BMPBest Management Practices
2. CGPConstruction General Permit
3. CSMP Construction Site Monitoring Program
4. CASQA California Stormwater Quality Association
5. EPA Environmental Protection Agency
6. ELAP Environmental Laboratory Accreditation Program
7. NOI Notice of Intent
8. NOT Notice of Termination
9. COI Change of Information
10. MS4 Municipal Separate Storm Sewer System
11. NPDES National Pollution Discharge Elimination System
12. QSDQualified SWPPP Developer
13. QSP Qualified SWPPP Practitioner
14. LRP Legally Responsible Person
15. PRD Permit Registration Documents
16. SMARTS Stormwater Multiple Application and Report Tracking System
17. SWPPP Storm Water Pollution Prevention Plan
18. SWRCB State Water Resources Control Board
19. RWQCB Regional Water Quality Control Board

1.3 RELATED SECTIONS

A. Contract General Conditions and Division 1, General Requirements
B. Section 31 11 00 – Site Clearing
C. Section 31 20 00 – Earthwork
D. Section 33 41 00 – Storm Drainage
E. Section 44 11 13 – Fugitive Dust Contol

1.4 REFERENCES

A. Construction General Permit:
1. 2022-0057-DWQ Construction General Permit
2. https://www.waterboards.ca.gov/water_issues/programs/stormwater/construction/general_permit_reissuance.html

B. Project SWPPP Document
1. Available on SMARTS once approved by SWRCB
2. Available by request from the Owner.

C. CASQA Construction BMP Handbook:

1. https://www.casqa.org/resources/bmp-handbooks
2. Appendix G of the Project SWPPP.

1.5 SUBMITTALS

A. All submittals shall be in accordance with the submittal requirements of these specifications.

B. The Contractor shall provide, to the Owner and QSD, the name, certification number, and contact information of their retained QSP within 30 days of starting construction.

C. The Contractor shall provide to the Owner and QSD, completed training records of QSP delegation to the Contractor within 30 days of starting construction.

D. The Contractor shall submit to the Owner and QSD the proposed product to be used at the site as soil binder or tackifier for the purposes of erosion control for approval.

E. The Contractor, QSP, or QSP Delegates shall submit to the Owner and QSD analytical laboratory results from stormwater sampling to the Owner and QSD within 48 hours of receiving analytical resulst from the laboratory.

F. The Contractor, QSP, or QSP Delagates shall submit to the Owner and QSD the dewatering field sampling results in the form of the Effluent Sampling Field Log within five days of an NAL exceedance for pH or turbidity.

G. The Contractor shall provide, to Owner and QSD, documentation of implementing all SWPPP requirements, for each Annual Report, within 30 calendar days of the end of each reporting period (reporting period is July 1 through June 30 of each year), or upon requesting to terminate the Project SWPPP.

H. Upon request from the Owner or Owner's agents, Contractor shall provide all documentation that is required throughout construction including, but not limited to, CSMP records, sampling records, non-stormwater spill and discharge events, rain logs, QSP-signed inspection reports for delegated reports, and completed QSP delegation training records.

1.6 REQUIREMENTS

A. General:
   1. Contractor is responsible for understanding and carrying out all provisions of the SWPPP, CGP, and any requirements from local agencies (except as excluded above in 1.1.B., where Owner responsibilities are specified).

2. The requirements of the CGP, SWPPP, MS4 permittee, and any other local regulations related to stormwater pollution prevention shall be reviewed by Contractor, prior to initiating any ground disturbance or other activities that could lead to stormwater pollution, for a full understanding of the intent, objectives, and implementation.
3. Contractor responsibilities begin immediately upon execution of the contract containing these specifications and continue until the SWPPP has been terminated with SWRCB.
4. Specific requirements include, but are not limited to:
    a. Daily weather monitoring and record keeping to identify upcoming storm events and required qualifying precipitation event-related inspections.
    b. Installation of an on-site rain gauge and daily rain gauge reading recording.
    c. Installation, implementation, and maintenance of BMPs, and prevention of prohibited activities and unauthorized non-stormwater discharges.
    d. Conducting and reporting to the QSD all non-visible pollutant release sampling and dewatering sampling.
    e. Ensure that all subcontractors and agents are trained to understand and implement their relevant responsibilities under the CGP, SWPPP, and these specifications.
    f. Pay any penalties, fines, and corrective action costs resulting from failure to comply with SWPPP, CGP, and local agency requirements, and hold the Owner/LRP harmless from any such failures.
    g. Ensure that all conditions are met for SWPPP termination including, but not limited to: fully stabilizing all disturbed areas of the site; removing temporary BMPs, construction materials, and equipment; cleaning the site of any storm water pollutants; and notifying Owner and QSD of acceptable termination conditions.

5. The SWPPP is an aid to the Contractor in complying with the CGP. CGP requirements shall take precedence over anything contained in the SWPPP, Contractor shall notify the Owner and QSD of any conflicts between the SWPPP and CGP, and no such conflicts shall relieve the Contractor of any responsibilities for execution of these specifications.
6. See the approved SWPPP for the determined Project risk level. The requirements associated with the project's risk level shall be found in the SWPPP.

B. Retaining a Qualified SWPPP Practitioner (QSP)
1. The Contractor shall retain a certified QSP who will have responsibility and oversight for the implementation of the CSMP elements of the SWPPP and CGP.
2. Contractor shall maintain documentation in the on-site SWPPP and digitally that proves a certified QSP conducted oversight of all SWPPP and CGP compliance activities including, but not limited to:
    a. CSMP inspections, training, weather forecast monitoring and recordkeeping, on-site rain gauge records, non-visible pollutant discharge sampling, and recordkeeping. The responsibilities of the Contractor's QSP are explained in Part 3, Section 3.1 of these SWPPP specifications.

C. Non-visible pollutant discharge sampling:

1. The Contractor's QSP shall train Contractor staff members on non-visible pollutant observation and sampling procedures of the CGP and Section 7 of the Project SWPPP. The QSP and QSP trained delegates shall conduct non-visible sampling when required by site observations and activites according to the CGP.
2. The Contractor shall be prepared with a pH field meter and calibration fluid and clean non-visible pollutant sample bottles and preservatives based on the current non-visible pollutants on-site, as identified in Section 7 of the Project SWPPP.
3. The Contractor shall be prepared to preserve stormwater samples on ice to 4° celsius immediately after taking stormwater samples and until being driven, picked-up, or shipped to an ELAP certified laboratory.
4. The Contractor shall pay for all costs related to non-visible pollutant sampling and laboratory analysis.
5. A QSP-trained and delegated Contractor staff member or the QSP shall:
    a. Always be available on-site within one hour during site operation hours to conduct non-visible pollutant discharge sampling as required by the CGP.
    b. Complete the non-visible pollutant sampling procedures identified in Section 7 of the Project SWPPP and according to the CGP immediately after the discovery of exposure of non-visible pollutants to stormwater that have a potential to discharge off-site.
    c. Take non-visible pollutant samples of effluent from waste dumpsters left uncovered during rainfall during site operation hours that have a potential to discharge off-site.
    d. Take non-visible pollutant samples of runnoff from demolished building materials left uncovered during rainfall during site operation hours that have a potential to discharge off-site.
6. The Contractor or QSP shall report analytical laboratory results from stormwater sampling to the Owner and QSD within 48 hours of receiving analytical resulst from the laboratory.
7. De-watering discharge sampling
8. Prior to conducting dewatering operations via pump or siphon that could result in discharge off-site, the Contractor shall contact the QSP to ensure that dewatering discharge can be sampled for pH and turbidity in accordance with the Appendix J of the CGP and Section 7 of the Project SWPPP.
9. The Contractor, QSP, or QSP trained delegates shall notify the Regional Water Quality Control Board via email 24-hours prior to the start of planned dewatering operations.
10. The Contractor, QSP, or QSP Delagates shall notify the QSD and LRP if dewatering sample results yielded an NAL exceedance for pH or turbidity within 5 calendar days of the exceedance, including the completed Effuluent Sampling Field Log.
11. The Contractor shall immediately cease dewatering operations if dewatering samples yield a result higher than 250 NTUs or is outside of the pH range for 6.5-8.5. The Contractor shall wait for sediment to settle/pH to neutralize or utilize BMPs to bring water for dewatering to be within the acceptable ranges of turbidity or pH when resuming dewatering operations.

D. The Contractor shall be responsible for achieving Final Stabilzation, as defined by the CGP, for all areas disturbed by Project construction activities in order to terminate the SWPPP within 90-days of completing construction activities, including areas without landscaping plans.
   1. The Contractor shall re-establish any existingng vegetation disturbed by the Project with the same vegetation type as was distrubed.
   2. The Contractor shall achieve Final Stabilization for all graded areas with no landscaping plan and disturbed pre-existing non-landscaped vegetation disturbed by the Project with either non-vegetative stabilization as defined by the CASQA Construction BMP Handbook or by use of seeding/hydroseeding with a native erosion control seed mix.

E. The Contractor shall be fully aware of the requirements for the full execution of the SWPPP; the requirements of these specifications for implementing, maintaining, and enforcing the provisions of the SWPPP; and the impact that the SWPPP will have on the operation, prosecution and cost of the work. A submittal of a bid on this project will be considered as prima facie evidence that the Contractor fully comprehends these requirements and impacts and has fully allowed for their effect on this project, both in time and cost. Failure to comply with the CGP is a violation of federal and state law. Contractor hereby agrees to indemnify, defend and hold harmless Owner, its officers, agents, and employees from and against any and all claims, demands, losses or liabilities of any kind or nature which Owner, its officers, agents, and employees may sustain or incur for noncompliance with the Permit arising out of or in connection with the Project, except for liability resulting from the negligence or willful misconduct of Owner, its officers, agents or employees. Owner may seek damages from Contractor for delay in completing the Project in accordance herewith, including damage caused by Contractor's failure to comply with Permit requirements.

1.7 QUALITY ASSURANCE

A. Certified SWPPP Professionals:
   1. Qualified SWPPP Developer (QSD)
      a. The Owner shall retain a certified QSD.
      b. The QSD's name, certification number, and contact information shall be listed within the SWPPP document.
   2. Qualified SWPPP Practitioner (QSP)
      a. The Contractor shall retain a certified QSP.
      b. The QSP's name, certification number, and contact information shall be provided to the Project QSD and in the on-site SWPPP.

B. Regulatory Requirements:
   1. Contractor shall comply with the lawful requirements of any applicable municipality, county, drainage district, municipal storm water management program and other local agencies regarding discharges of storm water to separate storm drain system or other watercourses under their jurisdiction, including but not limited to the following:
      a. EPA Environmental Protection Agency.
      b. FMFCD Fresno Metropolitan Flood Control District
      c. SWRCB State Water Resources Control Board.

d. RWQCB Regional Water Quality Control Board.

2. All stormwater compliance shall be in accordance with local regulations:
   a. County of Tulare.
   b. City of Visalia.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Best Management Practices (BMPs):
   1. The Contractor is responsible for the providing and furnishing all BMPs, products, and practices necessary to comply with the SWPPP and CGP. All materials and BMPs shall follow the CASQA Construction BMP Handbook and installed as described within the fact sheets, unless otherwise instructed by a qualified professional.
   2. The Contractor must provide, implement, and carry out all BMPs required to comply with the CGP, regardless of the BMPs contained in the SWPPP, and shall notify Owner and QSD of any conflicts between the SWPPP and CGP.
   3. The Contractor shall comply with the erosion control BMP requirements of the CGP, stating that BMPs must be initialized immediately to temporarily stabilize an area disturbed by construction where construction activities will not be resumed within 14 days (CGP Appendix D Section II.D.f).
   4. Prior to substantially altering BMPs recommended in the SWPPP, Contractor shall notify the Owner and QSD for review of the alternative BMPs and to obtain instructions for documenting the changes.
   5. Contractor shall consult with the QSP to ensure all BMPs are appropriate, feasible, effective, and correctly implemented.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Monitoring by the Contractor's QSP:
   1. Implement the CSMP and document all records in the SWPPP as required by the CGP, including, but not limited to: weekly, pre-storm, during-storm, post-storm, and quarterly inspections, daily weather monitoring, training of responsible contractor and subcontractor personell, and incidental non-visible pollutant discharge sampling.
      a. CSMP inspection reports:
         1) The QSP or QSP trained delegates shall include photographs showing all disturbed areas, BMPs, BMP deficiencies, material storage locations, stormwater containment areas, and active construction areas. All photographs shall include comments noting any BMP corrective actions and completed corrective actions.
         2) The QSP or QSP trained delegates shall document in their CSMP

Inspection reports when all outdoor construction activities have ceased.

b. QSP Training Records:
   1) The QSP or QSP trained delegates shall administer and document training of contractor and subcontractor staff responsible for BMP implementation, instillation, and maintenance and document it in the SWPPP.
   2) If QSP delegates any weekly/during storm inspections and/or non-visible pollutant discharge sampling requirements to Contractor personnel, QSP shall provide and document training to those personnel.
      a) If CSMP inspection shave been delegated, the QSP shall review and sign all documentation completed by the trained QSP delegate.

c. Weather Monitoring:
   1) The QSP or QSP trained delegates shall save records of daily weather monitoring of the nearest NOAA weather station.
   2) The QSP or QSP trained delegates shall record the daily on-site rain gauge reading and retain the records for the duration of the Project.

d. Incidental Non-Visible Pollutant Discharge Sampling:
   1) The QSP or QSP trained delegates shall perform any stormwater and non-stormwater sampling, as required by the CGP. If any samples are sent offsite for laboratory analysis, QSP will identify a designated ELAP-certified laboratory and coordinate sample procurement, transportation, analysis, and recordkeeping. If QSP delegates any of these duties to Contractor personnel, QSP shall provide training and document the training in the SWPPP. QSP shall upload sampling results to SMARTS.

e. De-watering Discharge Sampling
   1) Prior to conducting dewatering operations via pump or siphon that could result in discharge off-site, the Contractor shall contact the QSP to ensure that dewatering discharge can be sampled for pH and turbidity in accordance with the Appendix J of the CGP. The Contractor shall cease dewatering operations if dewatering samples yield a result higher than 250 NTUs or is outside of the pH range for 6.5-8.5. The Contractor shall wait for sediment to settle/pH to neutralize or utilize BMPs to bring water for dewatering to be within the acceptable ranges of turbidity or pH when resuming dewatering operations.

f. The QSP shall consult with the Contractor to understand the construction schedule and identify site areas where erosion control BMPs must be initialized immediately to temporarily stabilize an area disturbed by construction where construction activities will not be resumed within 14 days in accordance with CGP Appendix D Section II.D.f.

2. New CSMP records outlined above in Part 3, Section 3.1.A shall be provided by the QSP to the QSD and Owner on a bi-monthly basis while the SWPPP NOI is active. New CSMP records shall be sent in the first week of odd numbered months.
3. The QSP shall identify required amendments to the SWPPP based on construction activity and notify the QSD and Owner.
4. The QSP shall identify when the site area has achieved “final stabilization” per the CGP definition, and inform the QSD and Owner.
5. The Contractor’s QSP shall advise the Contractor on achieving final stabilization of all areas disturbed by the Project within 90-days of outdoor construction activities ceasing. The Contractor shall be responsible for achieving final stabilization, as defined by the CGP, for all areas disturbed by Project activities, including areas without landscaping plans.
6. For the full monitoring requirements refer to the SWPPP and CGP.

B. Monitoring by Owner
1. The Owner has the right to monitor and oversee the Contractor’s implementation and maintenance of the BMPs and SWPPP.
2. Should the Owner determine that the Contractor’s efforts fail to meet the requirements of the CGP and the SWPPP, the Owner reserves the right to employ any and/or all of the following actions:
   a. Notify the SWRCB of the perceived failure of the Contractor to comply with the CGP and SWPPP.
   b. Withhold an amount of money from the Contractor’s Payment Request, equal to the Owner’s estimate of the value of the work required to implement and maintain the required BMPs, as well as provide the required inspection, training, and testing forms.
   c. If the SWPPP is not terminated within 90-days of outdoor construction activities ceasing, withhold monies due the Conttractor under this Contract, in an amount sufficient to complete the work, pay any addiutional fees due the State, and close out the SWPPP in compliance with the General Permit.

C. Availability and access to the SWPPP:
1. As required by the SWPPP and CGP, the Contractor shall keep a minimum of one copy of the SWPPP, addenda, all PRDS, all inspection reports and all SWPPP records in the following locations:
   a. Contractor’s Project Site Field Office.
   b. Contractor’s General Business Office.
2. The SWPPP shall be made available for public inspection at any time during normal business hours.
3. All SWPPP records shall be made available to the Owner and their agents when requested.

3.2 CLEANING AND REMOVAL

A. Removal of BMPs
1. All temporary BMPs shall be completely removed from the Project Site prior to filing of the NOT.

2. The removal of any and all BMPs shall be coordinated and approved by the Contractor's QSP.
3. All permanent BMPs shall remain on the Project Site, unless directed otherwise by Owner. The Owner will be responsible for ongoing inspection and maintenance after final acceptance.

B. Under written agreement and with the approval of the Owner, the Contractor may assign maintenance and removal responsibilities of the project BMPs to a subsequent Contractor for later work phases at the Project Site.

3.3 RECORD KEEPING

A. Paper and electronic records of all CSMP inspections, testing, training reports, all PRDs, inspection records, site photos, and all other SWPPP related records, shall be retained for a period of at least three years after the close of construction. These records shall be available at the project site until construction is completed.

3.4 PAYMENT

A. Full compensation for all costs involved in implementing, and monitoring the implementation of the SWPPP for this project, including inspections, testing, and training, performing corrective measures as required to better implement the SWPPP, providing all labor, materials, and resources to maintain the SWPPP and all required records of the SWPPP, and being full liable for all failures to fulfill the intent and requirements of the CGP set forth by the SWRCB, shall be included in the cost bid for the various items of work and no additional payment will be made therefor.

END OF SECTION

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Division 01 Section "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, which is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Products: Products of a listed manufacturer that are demonstrated to meet or exceed the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified ‘Basis of Design’ product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.5 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.

5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.

    a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

2. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered.

    a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

3. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

    a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
    b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

4. Basis-of-Design Products: Where Specifications indicate a manufacturer and product indicated by the phrase “Basis of Design,” provide the product indicated.

    a. Where specifications list manufacturers of comparable products subject to compliance with requirements, comparable products complying with properties and characteristics based on the named product may be provided by one of the other named manufacturers.
    b. Where specifications do not list additional manufacturers, other products may be considered for substitution subject to compliance with requirements in Division 01 Section 012500 "Substitution Procedures" and compliance with properties and characteristics based on the named product.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

D. Visual Matching Specification: Where Specifications include the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

E. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

F. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.

1. Select products for which sustainable design documentation submittals are available from manufacturer.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable products when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Division 01 Section 013300 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting, patching and repairing.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Protection of existing construction.
10. Repair of the Work.

B. Related Requirements:

1. Division 01 Section "Summary of Work" for limits on use of Project site.
2. Division 01 Section "Submittal Procedures" for submitting surveys.
3. Division 02 Section "Selective Demolition" for demolition and removal of selected portions of the building.
4. Division 07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

A. Accessible Route: A continuous unobstructed path connecting accessible elements and spaces of an accessible site, building or facility that can be negotiated by a person with a disability using a wheelchair, and that is also safe for and usable by persons with other disabilities. Interior accessible routes may include corridors, hallways, floors, ramps, elevators and lifts. Exterior accessible routes may include accessible parking stalls and access aisles, curb ramps, crosswalks at vehicular ways, walks, ramps and lifts.

B. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

C. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 SUBMITTALS

A. Surveys: Submit survey of accessible route improvements stamped and signed by land surveyor or professional engineer certifying that elevations and slopes of improvements comply with disabled access requirements.

1. Survey shall be a separate submittal and shall also be included in the Project Record Documents.

1.5 QUALITY ASSURANCE

A. Surveyor Qualifications: A professional engineer or land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting of structural elements must be performed, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

a. Primary operational systems and equipment.

b. Fire separation assemblies.
c. Air or smoke barriers.
d. Fire-suppression systems.
e. Mechanical systems piping and ducts.
f. Control systems.
g. Communication systems.
h. Fire-detection and alarm systems.
i. Conveying systems.
j. Electrical wiring systems.
k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in

increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a. Water, moisture, or vapor barriers.

b. Membranes and flashings.
c. Sprayed fire-resistive material.
d. Equipment supports.
e. Piping, ductwork, vessels, and equipment.

4. Visual Elements: Cut and patch construction in a manner that results in no visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in Division 02 trough 33 Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for plumbing, mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings. Verify service space requirements for equipment and operating items.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Request for Information."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
3. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
4. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

B. Survey of Accessible Routes: On completion of site improvements, prepare a topographic survey of accessible routes showing dimensions, locations, and elevations of accessible features in order to certify compliance with requirements for disabled access. Survey shall be limited to site features included in the Work of the Project.

C. Certified Survey: On completion of site drainage features, foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

K. Repair or remove and replace damaged, defective, or nonconforming Work.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching and Repairing: Patch and repair construction by grinding, filling, leveling, refinishing, closing up, and similar operations following performance of other work. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched and repaired areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
    b. Where finishes have been removed, patch and repair substrates to receive new finishes; substrates shall be prepared to comply with requirements of manufacturer of final finish material.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 REPAIR OF THE WORK

A. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

3.8 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.9 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.10 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.11 PROTECTION AND REPAIR

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Comply with manufacturer's written instructions for temperature and relative humidity following installation.

D. Protection of Existing Items: Provide protection and ensure that existing items to remain are undisturbed by construction are maintained in condition that existed at commencement of the Work.

END OF SECTION

SECTION 017419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous construction and demolition waste.
2. Recycling nonhazardous construction and demolition waste.
3. Disposing of nonhazardous construction and demolition waste.

B. Related Requirements:

1. Division 02 Section "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements.
2. Division 02 Section "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
3. Division 04 Sections as applicable to masonry for disposal requirements for masonry waste.
4. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. CGBSC: California Green Building Standards Code.

B. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

C. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

D. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

E. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

F. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

G. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit Waste Management Plan within 30 days of date established for the Notice to Proceed indicating method of compliance with the California Green Building Standards Code.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use separate forms for construction waste and demolition waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator and refrigerant recovery technician.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employee assigned by the General Contractor, with a record of successful waste management coordination of projects with similar requirements. Individual of firm, or Contractor's employee, shall be a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.8 REGULATORY REQUIREMENTS

A. Construction Waste Management: Refer to CGBSC Section 5.408.1 Construction Waste Management. Recycle and/or salvage for reuse a minimum of 65 percent of the non-hazardous construction and demolition waste in accordance with CGBSC Section 5.408.1.1, 5.408.1.2, or 5.408.1.3 (Below) or meet a local construction and demolition waste management ordinance, whichever is more stringent:

1. GBSC Section 5.408.1.1, Construction Waste Management Plan: Where a local jurisdiction does not have a construction and demolition waste management ordinance that is more stringent, provide Waste Management Plan that:

a. Identifies the construction and demolition waste materials to be diverted from disposal by efficient usage, recycling, reuse on the project or salvage for future use or sale.
b. Determines if construction and demolition waste materials will be sorted on-site (source separated) or bulk mixed (single stream).
c. Identifies diversion facilities where construction and demolition waste material collected will be taken.
d. Specifies the amount of construction and demolition waste materials diverted shall be calculated by weight or volume, but not by both.

2. GBSC Section 5.408.1.2, Waste Management Company: Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with CGBSC Section 5.408.1.

a. Exception 1: Excavated soil and land-clearing debris.
b. Exception 2: Alternate waste reduction methods developed by working with local agencies if diversion or recycle facilities capable of compliance with this item do not exist.
c. Demolition waste meeting local ordinance or calculated in consideration of local recycling facilities and markets.

3. GBSC Section 5.408.1.3, Waste Stream Reduction Alternative: The combined weight of new construction disposal that does not exceed two pounds per square foot of building area may be deemed to meet the 65 percent minimum requirement as approved by the enforcing agency.

B. Documentation, CGBSC Section 5.408.1.4: Documentation shall be provided to the enforcing agency which demonstrates compliance with Sections 5.408.1.1. through 5.408.1.3. The Waste management plan shall be updated as necessary and shall be accessible during construction for examination by the enforcing agency.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management procedures. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management procedures during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Division 01 Section "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management procedures to everyone concerned within three days of submittal return.
2. Distribute waste management procedures to entities when they first begin work on-site. Review procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. General: Contract Documents identify items to be salvaged for reinstallation and items to be salvaged to the Owner; items indicated to be removed become the Contractor’s property, Contractor may salvage removed items and offer for sale and/or donation.

B. Salvaged Items for Reuse/Reinstallion in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

C. Salvaged Items to Owner: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Salvaged Items for Sale and/or Donation: Not permitted on Project site.

E. Salvaged Items for Reinstallation or Owner’s Use:

1. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

2. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
3. Plumbing Fixtures: Separate by type and size.
4. Lighting Fixtures: Separate lamps by type and protect from breakage.
5. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: Refer to local county websites for the county in which the Project is located for listings of available recycling receivers and processors, and materials accepted.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

D. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

E. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Clean and stack undamaged, whole masonry units on wood pallets.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Metal Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

M. Metal Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.

3. Wood Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

a. Comply with requirements in Division 32 Sections as applicable to planting for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

3.6 UNIVERSAL WASTE

A. Additions and alterations to a building shall require verification that Universal Waste items such as fluorescent lamps and mercury containing ballasts and thermostats as well as other California prohibited Universal waste materials are disposed of properly and are diverted from landfills.

1. Refer to Universal Waste Rule link at https://dtsc.ca.gov/universalwaste/.

3.7 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 017700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. Final cleaning.
4. Repair of the Work.

B. Related Requirements:

1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Division 01 Section "Execution" for repair of the Work.
3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance documentation requirements.
4. Division 01 Section "Project Record Drawings" for preparing and submitting Project Record Drawings.
5. Division 01 Section "Warranties" for submitting final warranty information.
6. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
7. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Contractor's List of Incomplete Items: Final submittal at Final Completion.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Submit the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record drawings, operation and maintenance data, construction photographic documentation, warranties, and similar final record information.
3. Submit closeout submittals specified in individual Division 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance materials specified in individual Division 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements, including touchup painting.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection for Completion a minimum of 10 days prior to date the work will be completed and ready for inspection. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Following inspection, Architect will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected.

1. Architect’s Punch List: During inspection, Architect will prepare a list of items needing completion or correction (punch list), a copy of the punch list will be distributed to the Contractor and Owner.
2. Reinspection: Request reinspection when the Work identified in previous inspection as incomplete is completed or corrected.
3. Results of completed inspection will form the basis of requirements for final completion.

E. Contractor’s Cost for Reinspection: Architect will perform one inspection and one reinspection at no additional cost to the Contractor. The expense for the Architect’s time for additional inspections will be paid by the Owner with the amount being deducted from the Contract Sum. The expense will be based on an hourly rate in accordance with the Architect’s standard hourly rate schedule in effect at the time the work is performed with a minimum of $400.00 dollars for each additional reinspection.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. List of Incomplete Items: Submit copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect; copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Architect (Company name).
d. Name of Contractor (Company Name).
e. Page number.

4. Submit list of incomplete items in one of the following formats:

a. MS Excel electronic file. Architect will return annotated file.
b. PDF electronic file. Architect will return annotated file.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with the California Green Building Standards Code maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for Completion for entire Project or for a designated portion of Project:

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    g. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
    h. Vacuum and mop concrete.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    k. Remove labels that are not permanent.
    l. Wipe surfaces of mechanical, electrical, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    q. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Division 01 Section 017300 “Execution” before requesting inspection for determination of Substantial Completion.

1. Comply with requirements of Division 02 through 33 Sections as applicable to the Work to be restored and/or repaired.

END OF SECTION

SECTION 017823
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance documentation, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Sections:

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 01 Section "Demonstration and Training" for demonstration and training materials.
3. Division 01 Section "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.
4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 SUBMITTALS

A. Closeout Submittal: Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as previously reviewed and approved at the time of individual Section submittals; where applicable, clarify and update previously reviewed content to correspond to revisions and field conditions. Submit reviewed manual content formatted and organized as required by this Section.

1. Initial Submittal: Submit draft electronic copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether content of operations and maintenance submittal is acceptable.

a. Correct or revise each manual to comply with Architect's comments. Submit final submittal copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

2. Final Submittal: Submit in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Submit the following:

a. Paper Copy: Submit one paper-copy set of marked-up record prints that have been revised to address Architect’s comments from the initial submittal.
b. Digital Data Files: Submit digital data files of Project Record Drawings as PDF files on a thumb-drive.

B. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Electronic File Manuals: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Paper Copy Manuals: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf or post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter

of contents, and indicate Specification Section number(s) on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.5 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials and in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information as applicable:

1. Subject matter included in the manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for the following:

    a. Contractor.
    b. Installer.
    c. Architect.
    d. Commissioning Authority if applicable.
    e. Architect’s major consultants that designed the systems contained in the manuals.

6. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identify by product name and arrange to match table of contents. For each piece of equipment, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in data identified by product name and arranged to match table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017836

WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

B. Related Sections include but are not limited to the following:

1. Division 01 Section "Closeout Procedures."
2. Division 01 Section "Operation and Maintenance Data."
3. Division 02 through 33 Sections for specific warranty requirements.

1.3 DEFINITIONS

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special project warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

B. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

C. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

D. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

E. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

    1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

F. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Warranty Submittal: Submit (2) paper copies and one electronic copy of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer.

    1. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
    2. Provide additional copies of each warranty in operation and maintenance manuals.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

    1. Submit by email to Architect.

D. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017839

PROJECT RECORD DRAWINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Drawings:

B. Related Sections:

1. Division 01 Section "Use of Architect’s Electronic Files” for requirements related to use of Architect's digital data files.
2. Division 01 Section "Execution" for surveys of exterior accessible routes.
3. Division 01 Section "Closeout Procedures" for general closeout procedures.
4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 RECORD DRAWING SUBMITTAL

A. Closeout Submittal: Submit Record Drawings as follows:

1. Initial Submittal: Submit one paper-copy set of marked-up record prints.

    a. Architect will indicate whether record prints are acceptable or if additional information or documentation is needed, and will return the set to the Contractor.

2. Final Submittal:

    a. Paper Copy: Submit one paper-copy set of marked-up record prints that have been revised to address Architect’s comments from the initial submittal.
    b. Digital Data Files: Submit digital data files of Project Record Drawings as PDF files on a thumb-drive.

1.4 PROJECT RECORD DRAWINGS

A. Record Drawings: Maintain one set of paper copies of the Contract Drawings during the construction period for Project Record Drawing Purposes.

1. Project Record Drawing print sets shall include all drawings of the Contract Documents including original project Drawings, Shop Drawings, Supplemental Drawings, Coordination Drawings, Clarification Drawings, Change Orders, and similar drawings. Record Drawing set shall include all drawings of Contract Documents whether or not changes and additional information were recorded.
2. Store Project Record Drawings in the field office apart from the Contract Documents used for construction; do not use Project Record Drawings for construction purposes.
3. Maintain Record Drawings in good order and in a clean, dry, legible condition, protected from deterioration and loss.
4. Provide access to Project Record Drawings for Architect's reference during normal working hours.
5. Incorporate new and revised drawings into Project Record Drawings as modifications are issued; do not wait until the end of Project.
6. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

7. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

8. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
9. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
10. Mark important additional information that was either shown schematically or omitted from original Drawings.
11. Note Construction Change Directive numbers, Change Order numbers, and similar identification, where applicable.

B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

C. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, submit marked-up record prints to Architect, following Architect's review and action, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: PDF electronic file.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings in PDF format for use in recording information.

    a. Refer to Division 01 Section 011105 "Use of Architect's Electronic Files" for requirements related to use of Architect's digital data files.

D. Format:

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Digital Data Files:

    a. Format: Annotated PDF electronic file.
    b. Organize digital data information into separate electronic files corresponding with each building design discipline of the Contract Documents; name each file with the corresponding design discipline.

E. Identification: Include the following information on each Record Drawing:

1. "PROJECT RECORD DRAWING" designation located in a prominent location.
2. Project name if Project name is not included in a title block as part of the drawing.
3. Date.
4. Name of Architect if Architect's name is not included in a title block as part of the drawing.
5. Name of Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel in operation and maintenance of systems, subsystems, and equipment.

B. Related Sections:

1. Division 01 Section “Operation and Maintenance Data” for operation and maintenance manuals and data.
2. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS

A. Training materials in addition to Operation and Maintenance manuals required in Division 01 Section “Operation and Maintenance Data.”

B. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Schedule shall be coordinated and finalized with the Owner.

C. Qualification Data: For instructor.

D. Attendance Record: For each training module, submit list of participants and length of instruction time.

E. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training of Owner’s personnel.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved operation and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Provide instruction programs that include training sessions for each system and for equipment not part of a system, as required by individual Specification Sections. Include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Operating standards.
    c. Regulatory requirements.
    d. Equipment function.
    e. Operating characteristics.
    f. Limiting conditions.
    g. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.

c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction and training. Assemble training manuals organized in coordination with requirements in Division 01 Section "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Develop instruction program and prepare training modules; coordinate instructors, and coordinate with Owner for the number of participants, instruction times, and locations.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule initial training with Owner**,** through Architect, with at least 7 days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of [**an oral**] [**a written**] [**a demonstration**] performance-based test.

F. Cleanup: Collect used and leftover educational materials and deliver to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 018113
SUSTAINABLE DESIGN REQUIREMENTS, DSA CALGREEN

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with the 2022 California Green Building Standards Code (CGBSC) for Division of the State Architect (DSA) requirements.

B. Related Sections:

1. Project Manual Appendix No. 2, DSA Form 403-C “CALGREEN CODE SUMBITTAL CHECKLIST.”

1.3 SUBMITTALS

A. Submit Sustainable Design Requirement submittals as required by Division 02 through 33 Specification Sections. Submittals may include, but are not limited to, the following:

1. Construction Waste Management Plan and other submittals as required by Division 01 Section "Construction Waste Management and Disposal."
2. Air Quality: Product data for filtration media.
3. Product data for adhesives, sealants, and coatings indicating VOC content of each product used.
4. Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

1.4 REGULATORY REQUIREMENTS

A. DSA Form 403-C “CALGREEN CODE SUMBITTAL CHECKLIST.”

1. DSA Form 403-C completed by Architect and included in the Appendix of this Project Manual; design and construction to comply with requirements indicated.

B. California Code of Regulations, Title 24, Part 11, California Green Building Standards Code (CGBSC). Requirements include but are not limited to the following:

1. Construction Waste Management: Comply with requirements of the 2022 CGBSC, Section 5.408.1 and Division 01 Section “Construction Waste Management and Disposal.” Construction Waste Management shall include, but not be limited to, the following:

   a. Construction Waste Management Plan.
   b. Recycling, reuse, and/or salvaging non-hazardous construction waste.

2. Environmental Quality/Pollutant Control: Comply with requirements of the 2022 CGBSC, Sections as follows:

   a. Section 5.504.3, Covering of Duct Openings and Protection of Mechanical equipment. At the time of rough installation and during storage on the construction site until final startup of the heating, cooling and ventilating equipment, all duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal or other methods acceptable to the enforcing agency to reduce the amount of dust, water and debris which may enter the system.
   b. Section 5.504.4.1, Adhesives and Sealants: Adhesives and sealants shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

      1) Adhesives: 2022 CGBSC Table 5.504.4.1 Adhesive VOC Limit:

         a) Indoor Carpet Adhesives: 50 g/L.
         b) Carpet Pad Adhesives: 50 g/L.
         c) Rubber Floor Adhesives: 60 g/L.
         d) Wood Flooring Adhesive: 100 g/L.
         e) Subfloor Adhesives: 50 g/L.
         f) Ceramic Tile Adhesives: 65 g/L.
         g) VCT and Asphalt Tile Adhesives: 50 g/L.
         h) Gypsum Board and Panel Adhesives: 50 g/L.
         i) Cove Base Adhesives: 50 g/L.
         j) Multipurpose Construction Adhesives: 70 g/L.
         k) Structural Glazing Adhesives: 100 g/L.
         l) Single-Ply Roof Membrane Adhesive: 250 g/L.
         m) Other Adhesives not specifically listed: 50 g/L.
         n) PVC Welding Compounds: 510 g/L.
         o) CPVC Welding Compounds: 490 g/L.
         p) ABS Welding Compounds: 325 g/L.
         q) Plastic Cement Welding Compounds: 250 g/L.
         r) Adhesive Primer for Plastic: 550 g/L.
         s) Contact Adhesive: 80 g/L.
         t) Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine-covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
         u) Structural Wood Member Adhesive: 140 g/L.

v) Top and Trim Adhesive: 250 g/L.
w) Metal-to-Metal Adhesives: 30 g/L.
x) Plastic Foam Adhesives: 50 g/L.
y) Adhesives for Porous Materials (Except Wood): 50 g/L.
z) Wood Glues: 30 g/L.
aa) Fiberglass Adhesives: 80 g/L.

2) Sealants: 2022 CGBSC Table 5.504.4.2, Sealant VOC Limit:

a) Architectural Sealants: 250 g/L.
b) Nonmembrane Roof Sealants: 300 g/L.
c) Paving Sealants: 250 g/L.
d) Single-Ply Roof Membrane Sealants: 450 g/L.
e) Other Sealants: 420 g/L.
f) Sealant Primers for Nonporous Substrates: 250 g/L.
g) Sealant Primers for Porous Substrates: 775 g/L.
h) Modified Bituminous Sealant Primers: 500 g/L.
i) Other Sealant Primers: 750 g/L.

c. Section 5.504.4.3, Paints and Coatings: Architectural Coatings shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1) Paints and Coatings: 2022 CGBSC Table 5.504.4.3, VOC Content Limits for Architectural Coatings:

a) Flat Paints and Coatings: VOC not more than 50 g/L.
b) Nonflat Paints and Coatings: VOC not more than 100 g/L.
c) Nonflat High-Gloss Paints and Coatings: VOC not more than 150 g/L.
d) Dry-Fog Coatings: VOC not more than 150 g/L.
e) Floor Coatings: VOC not more than 100 g/L.
f) Pretreatment Wash Primers: VOC not more than 420 g/L.
g) Primers, Sealers, and Undercoaters: VOC not more than 100 g/L.
h) Rust Preventative Coatings Applied to Ferrous Metals: VOC not more than 250 g/L.
i) Shellacs, Clear: VOC not more than 730 g/L.
j) Shellacs, Pigmented: VOC not more than 550 g/L.
k) Stains: VOC not more than 250 g/L.
l) Clear Wood Finishes, Varnishes: VOC not more than 275 g/L.
m) Clear Wood Finishes, Lacquers: VOC not more than 275 g/L.

n) Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.

d. Section 5.504.4.3.1, Aerosol Paints and Coatings: Aerosol paints and coatings shall meet the PWMIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Sections 94522(c)(2) and (d)(2) of California Code of Regulations, Title 17, commencing with Section 94520; and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8 Rule 49. Comply with requirements of 2022 CGBSC, Table 5.504.4.3.

3. Carpet Systems: Comply with requirements of CGBSC, Section 5.504.4.4.

   a. All carpet installed in the building interior shall meet the requirements of California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).

      1) See California Department of Public Health’s website for certification programs and testing labs.

   b. Carpet Adhesive: VOC content not exceeding 50 g/L per CGBSC Table 5.504.4.1 when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

4. Composite Wood Products: Comply with requirements of CGBSC Section 5.504.4.5; hardwood plywood, particleboard, and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB’s Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) Those materials not exempted by the ATCM must meet the specified emission limits, as shown in CGBSC Table 5.504.4.5.

5. Resilient Flooring Systems: Comply with requirements CGBSC, Section 5.504.4.6.

   a. Where resilient flooring is installed, at least 80% of floor area receiving resilient flooring shall meet the requirements of California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).
   b. Resilient Floor Adhesive: VOC content not exceeding 50 g/L per CGBSC Table 5.504.4.1 when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

6. Thermal Insulation: Comply with requirements of CGBSC, Section 5.504.4.7.

    a. All thermal insulation installed in buildings shall comply with the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).

        1) See California Department of Public Health’s website for certification programs and testing labs.

7. Acoustical Ceilings and Wall Panels: Comply with requirements of CGBSC, Section 5.504.4.8.

    a. Acoustical ceiling and wall panels installed in building interiors shall comply with the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).

        1) See California Department of Public Health’s website for certification programs and testing labs.

8. HVAC Filters: Comply with requirements CGBSC, Section 5.504.5.3; in mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media for outside and return air prior to occupancy that provides at least a Minimum Efficiency Reporting Value (MERV) of 13. MERV 13 filters shall be installed prior to occupancy and recommendations for maintenance with filters of the same value shall be included in the operation and maintenance manual.

    a. Exception: Existing mechanical equipment.
    b. Labeling: Installed filters shall be clearly labeled by the manufacturer indicating the MERV rating.

9. Acoustical Control: Comply with requirements CGBSC, Section 5.507.4, employ building assemblies and components with Sound Transmission Class (STC) values determined in accordance with ASTM E 90 and ASTM E 413 or Outdoor–Indoor Sound Transmission Class (OITC) determined in accordance with ASTM E 1332, using either the prescriptive or performance method in CGBSC Section 5.507.4.1 or 5.507.4.2.

    a. Exception:

        1) Buildings with few or no occupants or where occupants are not likely to be affected by exterior noise, as determined by the enforcement authority, such as factories, stadiums, storage, enclosed parking structures and utility buildings.

2) Exception: For public schools and community colleges, the requirements of CGBSC Section 5.507.4, and all subsections, apply only to new construction.

10. Interior Sound Transmission: Comply with requirements CGBSC, Section 5.507.4.3; wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public places shall have an STC of at least 40.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 019113
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Owner’s Project Requirements (OPR) and Basis of Design (BoD) documentation are included by reference for information only.

1.2 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. Related Sections:

1. Division 23 Section "Commissioning of HVAC Systems" for commissioning process activities for HVAC systems, assemblies, equipment, and components.

1.3 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority.

D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and each Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and each Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 EACH CONTRACTOR'S RESPONSIBILITIES

A. Each Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings held on a regularly scheduled basis.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete paper and/or electronic construction checklists as Work is completed and provide to the Commissioning Authority on a predetermined daily or weekly basis.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings.

D. Provide Project-specific construction checklists and commissioning process test procedures.

E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

F. Prepare and maintain the Issues Log.

G. Prepare and maintain completed construction checklist log.

H. Witness systems, assemblies, equipment, and component startup.

I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 023000

SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes information for the Geotechnical Investigation Report prepared for this Project.

B. Related Sections:

1. Division 31 Sections as applicable to site clearing, earthwork, excavations, fill, trenching, and paving.

1.3 GEOTECHNICAL REPORT

A. A Geotechnical report for this project has been prepared by:

Soils Engineering, Inc.
4400 Yeager Way
Bakersfield, CA 93313
(661) 831-5100

SEI File No. 24-19596

B. A copy of the Geotechnical Investigation Report is contained in the Appendix of this Project Manual.

C. The Geotechnical Investigation Report shall be considered to be a part of the Contract Documents. The Contractor shall become familiar and comply with the requirements and recommendations in the Report.

D. The Geotechnical Investigation Report identifies subsurface soil and ground water conditions and offers recommendations for earthwork and preparation of subsurface conditions for the Work of this Project.

E. The Geotechnical Investigation Report is not a warranty of subsurface conditions. Should subsurface conditions be found to vary substantially from the Report, changes in design and construction of foundations may be made by the Architect, with resulting credits or expenditures to the Contract sum accruing to the Owner.

1.4 QUALITY ASSURANCE

A. A soil engineer will be retained by the Owner to observe performance of work in connection with excavating, trenching, filling, backfilling, and grading, and to perform compaction tests.

1. Requirements for Field Quality Control are included in individual Sections as applicable to excavating, trenching, filling, backfilling, and grading.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 024116
STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings.
2. Demolition and removal of site improvements.
3. Abandoning in-place and Removing below-grade construction as indicated on drawings.
4. Disconnecting, capping or sealing, and abandoning in-place or removing site utilities as indicated on drawings.
5. Salvaging items for reuse by Owner.

B. Related Requirements:

1. Division 01 Section "Summary" for use of the premises and phasing requirements.
2. Division 01 Section "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
3. Division 02 Section "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
4. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse or store for reinstallation, as indicated on Drawings. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review applicable environmental and pollution control requirements.
8. Review items to be salvaged and returned to Owner.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and for noise control. Indicate proposed locations and construction of barriers.

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

C. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

D. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Division 01 Section "Photographic Documentation." Submit before the Work begins.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Building(s) to be demolished will be vacated and use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before building demolition, Owner will remove the following items:

a. To be determined prior to bid and issued by Addenda, if any.

D. Hazardous Materials: It is expected that hazardous materials will not be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Hazardous Materials: Present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

F. On-site storage or sale of removed items or materials is not permitted.

1.10 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

D. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations. Comply with Division 01 Section "Photographic Documentation.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

B. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.

1. Coordinate termination of utilities with Owner.
2. Arrange to shut off utilities with utility companies.
3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
4. Cut off pipe or conduit a minimum of 24 inchesbelow grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
5. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring: Design, provide, and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

    a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 01 Section "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least **8** hours after flame-cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.

2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be removed and salvaged are indicated on Drawings.

D. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction. Abandon below-grade construction outside this area.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely where indicated or to at least 18 inches below grade or to depths indicated.

E. Existing Utilities: Demolish existing utilities and below-grade utility structures indicated that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area unless indicated for removal.

1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Division 31 Section "Earth Moving."

3.7 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Division 31 Section "Earth Moving."

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

1. At locations indicated for new future (Increment 2) buildings and structures, provide over-excavation, and grading as required for building pad and adjacent site structures to 5 feet minimum beyond outer perimeter. Building pad shall be provided under Division 31 and 32 work.

3.8 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them according to Division 01 Section "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.10 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION

SECTION 024119

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected site elements not included in specification Section “Structure Demolition”.

B. Related Sections include the following:

1. Demolition and removal work indicated in scope.
2. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
3. Division 01 Section "Photographic Documentation" for photographic documentation of pre-demolition conditions.
4. Division 01 Section "Execution" for cutting and patching procedures, and for protection of existing construction.
5. Division 01 Section “Construction Waste Management and Disposal” for salvaging, recycling, and disposing of nonhazardous demolition and construction waste.
6. Division 31 Section “Site Clearing” for removing above and below-grade site improvements not part of selective demolition.
7. Project Manual Appendix for hazardous materials survey and Owner’s requirements for removal and/or remediation of hazardous materials, if any.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be salvaged or reinstalled.

B. Remove and Salvage to Owner: Detach item from existing construction in a manner to prevent damage and deliver to Owner ready for reuse.

C. Remove and Salvage for Reinstallation: Detach item from existing construction in a manner to prevent damage, prepare for reuse, and securely store item until it is to be reinstalled at locations indicated.

D. Existing to Remain: Existing items or improvements that are to remain and not be removed. Existing items to remain shall be protected from damage during the course of construction.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for physical damage, for dust control, and for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.

C. Predemolition Photographs: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Division 01 Section "Photographic Documentation." Submit before Work begins.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition.

1.7 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographs. Comply with requirements specified in Division 01 Section "Photographic Documentation."

C. Owner will occupy portions of site immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

D. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

E. Hazardous Materials: It is expected that hazardous materials will not be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

F. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

G. Storage or sale of removed items or materials on-site is not permitted.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

1. If unanticipated mechanical, electrical, or structural elements are encountered and found to be in conflict with intended function or design, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

C. Inventory and record the condition of items to be removed and salvaged or removed and reinstalled. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3.2 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Protection of Existing Construction: Protect existing construction to remain with temporary protections and construction. Do not remove existing construction unless otherwise indicated.

D. Remove temporary barricades and protections where hazards no longer exist.

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with Owner and/or utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use plasma or flame cutting torches without written approval from Architect. Where allowed, clear area of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations. Maintain fire watch during and for at least two hours after flame-cutting operations. Maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

7. Dispose of demolished items and materials promptly, comply with requirements of Division 01 Section “Construction Waste Management and Disposal.”

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

B. Concrete Slabs-on-Grade: Using power-driven saw, cut perimeter of area to be demolished, then break up and remove.

1. Where possible or feasible, cut concrete at existing joints.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Recycle or dispose demolition waste materials according to Division 01 Section "Construction Waste Management and Disposal." Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in accordance with local regulations and in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 031512
POST INSTALLED CONCRETE AND MASONRY ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following types of post installed anchors:

1. Expansion anchors.
2. Sleeve anchors.
3. Drop-in anchors.
4. Adhesive anchors.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete."
2. Division 05 Section "Structural Steel Framing."
3. Division 05 Section "Metal Fabrications."

1.3 REFERENCES

A. ACI:

1. ACI 318 – Building Code Requirements for Structural Concrete
2. ACI 355.2 – Standard for Evaluating the Performance of Post-Installed Mechanical Anchors in Concrete

B. ASTM:

1. ASTM A36 – Standard Specification for Carbon Structural Steel
2. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3. ASTM A193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
4. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
5. ASTM A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
6. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

7. ASTM B695 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
8. ASTM C881 – Standard Specification Epoxy-Resin-Based Bonding Systems for Concrete
9. ASTM E488 – Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
10. ASTM E1512 – Standard Test Methods for Testing Bond Performance of Bonded Anchors
11. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

C. Federal Specifications A-A-1922A, A-A01923A and A-A-55614 for Expansion and Shield-Type Anchors

D. ICC-ES

1. ICC-ES AC01 – Acceptance Criteria for Expansion Anchors in Masonry Elements
2. ICC-ES AC58 – Acceptance Criteria for Adhesive Anchors in Masonry Elements
3. ICC-ES AC70 – Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel and Masonry Elements
4. ICC-ES AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
5. ICC-ES AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include manufacturer's written installation instructions, physical characteristics, and load tables.

B. Evaluation Reports: From ICC-ES or IAPMO ES for each type of post installed anchor indicated.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed post-installed anchor installations similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of not less than 3 years of successful in-service performance.

B. Evaluation Service Approval: Use only products that have current ICC or IAPMO Evaluation Service approval.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to job site in manufacturer's or distributor's packaging undamaged, complete with installation instructions.

B. Protect and handle materials in accordance with manufacturer's recommendations to prevent damage or deterioration.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Carbon and Alloy Steel Nuts: ASTM A563.

B. Carbon Steel Washers: ASTM F436.

C. Carbon Steel Threaded Rod: ASTM F 1554; or ASTM A193 Grade B7; or ISO 898 Class 5.8.

D. Wedge Anchors: ASTM A510; or ASTM A108.

E. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593.

F. Stainless Steel Nuts: ASTM F594.

G. Zinc Plating: ASTM B633.

H. Hot-Dip Galvanizing: ASTM A153.

2.2 POST INSTALLED ANCHORS

A. Basis of Design: Post installed anchors shall be of manufacturer, type, and size as indicated on Drawings; manufacturers indicated on the Drawings are selected from the following:

1. Hilti Corporation.
2. Simpson Strong-Tie Company.

B. Post installed Anchors, General:

1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in solid grouted unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts (Type 304), ASTM F 593, and nuts, ASTM F 594.

C. Expansion Anchors: Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES AC01 or ICC ES AC193. Type and size as indicated on Drawings.

1. Anchorage to Grouted Masonry, provide one of the following:

    a. Hilti Kwik Bolt TZ2, ICC ESR-4561.
    b. Simpson Strong-Tie, Strong-Bolt 2 wedge anchor, IAPMO ER-0240.

2. Anchorage to Concrete, provide one of the following:

    a. Hilti Kwik Bolt TZ2, ICC ESR-4266 (carbon steel and AISI Type 304 Stainless Steel).
    b. Simpson Strong-Tie, Strong-Bolt 2 wedge anchor, ICC ESR-3037.

D. Sleeve Anchors: Torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES AC01 or ICC ES AC193. Type and size as indicated on Drawings.

1. Subject to compliance with requirements, provide anchor indicated on Drawings or one of the following:

    a. Hilti: HAD-P Undercut Anchor, ICC ESR-1546
    b. Submit Request for Substitution.

E. Drop-in Anchors: Flush, internally threaded shell anchor, bottom bearing type with a slotted single piece steel shell and a tapered expander plug providing 360 degree contact with the base material. Type and size as indicated on Drawings.

1. Subject to compliance with requirements, provide anchor indicated on Drawings or one of the following:

    a. Hilti; HDI-P TZ Drop-in Anchor, ICC ESR-4236.
    b. Submit Request for Substitution.

F. Adhesive Anchors: Two component, all-weather, high-performance epoxy complying with descriptive requirements of ASTM C 881, Type IV, Grade 3, Classes A, B, and C, except for gel time; mixed and dispensed through motionless, static mixing nozzle and dispensing tool. Threaded steel rod inserts or reinforcing dowels, complete with nuts, washers, adhesive injection system, and manufacturer’s installation instructions. Type and size as indicated on Drawings.

1. Anchorage to Grouted Masonry, provide one of the following:

    a. Hilti: Threaded rods or steel reinforcing bars with HIT HY-270 Adhesive Anchorage System, ICC ESR-4143.
    b. Simpson Strong-Tie: Threaded rods or steel reinforcing bars with SET-XP Adhesive Anchorage System, IAPMO ES-0265.

2. Anchorage to Concrete, provide one of the following:

    a. Hilti: Threaded rods or steel reinforcing bars with HIT RE 500 V3 Adhesive Anchoring System, ICC ESR-3814.
    b. Simpson Strong-Tie: Threaded rods or steel reinforcing bars with SET-3G Adhesive Anchorage System, ICC ESR-4057.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install anchors in accordance with manufacturer's written installation instructions and as indicated on Drawings.

B. Drilling Concrete and Concrete Unit Masonry:

1. Base Material Strength: Do not drill holes in concrete or masonry until concrete, mortar, and/or grout complies with the following for the type of anchor indicated:

    a. Expansion Anchors: Do not drill base material until base material has cured 28 days minimum.
    b. Adhesive Anchors: Do not drill base material until base material has cured 7 days minimum.

2. Drill holes with rotary impact hammer drills using carbide-tipped bits and core drills using diamond core bits. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete or masonry surface.

    a. Cored Holes: Where anchors are to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer.
    b. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.

C. Wedge Anchors, Sleeve Anchors, and Undercut Anchors: Protect threads from damage during anchor installation. Sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Architect.

D. Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

E. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

3.3 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Base Material Strength: Do not test anchors until base material has cured for a minimum of 28 days and has achieved design strength.

C. Testing per 2022 CBC 1910A.5: Each type and size of drilled-in anchor shall be proof loaded by the independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Structural Engineer. If any anchor fails testing, all anchors of the same type, diameter, and which were installed by the same trade and not previously tested, shall be tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

1. Minimum anchor embedments, proof loads and torques shall be as indicated on the Drawings.
2. Torque shall be applied with a calibrated torque wrench.
3. Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed D/10, where D is the nominal anchor diameter.
4. Testing frequency shall be per 2022 CBC 1910A.5.3.

    a. Sill Plate Bolting: Test 10 percent of anchors.
    b. Structural Applications other than Sill Plate Bolting: Test all anchors.

c. Non-Structural Applications (Equipment Anchorage): Test 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

5. Test acceptance criteria shall be per 2022 CBC 1910A.5.5.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Slabs-on-grade.
3. Elevated composite concrete and metal deck floors.
4. Concrete fill for metal pan stair treads and landings.

B. Related Sections:

1. Division 01 Section “Quality and Testing Requirements” for administrative and procedural requirements for quality assurance including independent testing requirements.
2. Division 03 Section "Topical Concrete Vapor Control Barrier.”
3. Division 03 Section "Polished Concrete Finishing” for concrete slabs that are to be polished and colored.
4. Division 05 Section “Metal Stairs” for custom precast composite high strength concrete treads and risers.
5. Division 07 Section “Underslab Vapor Retarder.”
6. Division 22 and 23 Sections as applicable to Plumbing and Mechanical items embedded in concrete.
7. Division 26 Sections as applicable to Electrical items embedded in concrete.
8. Division 31 Sections as applicable to earthwork.
9. Division 32 Sections as applicable to concrete paving and site concrete work.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1. Shop drawings shall be in accordance with ACI SP-66 or CRSI “Manual of Standard Practice.”
2. Mill certificates: Steel producer's certificates of mill analysis, tensile, and bend tests for reinforcing steel. Submit certificates accompanying the Shop Drawings.

D. Construction Joint Layout Shop Drawings: Show locations of proposed construction and control joints other than, or in addition to, those as indicated on the drawings. Location of joints is subject to approval of the Architect.

E. Qualification Data: For the Ready-mixed concrete manufacturer, include copies of applicable ACI certificates.

F. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

G. Material Test Reports: For aggregates, from a qualified testing agency, indicating compliance with requirements:

H. Mill certificates: Steel producer's certificates of mill analysis, tensile, and bend tests for reinforcing steel. Submit certificates accompanying the Shop Drawings.

I. Steel Reinforcement Record Drawings: Shop drawings shall be corrected to reflect actual field changes and shall be submitted to the Architect.

J. Welding certificates.

K. Delivery Tags: Delivery tags for all concrete.

L. Batch Plant Inspection Waiver: When batch plant inspection waiver is requested, evidence of compliance shall be submitted to, and approved by, the Governing Agency; refer to requirements in Part 3 Article “Field Quality Control.”

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills required for work performed under this Section. In actual installation of the work of this Section, use adequate numbers of skilled workmen to insure installation in strict accordance with the contract documents design.

B. Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer shall be certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency: An independent agency retained by the Owner, acceptable to the Architect, and qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 318-19, “Building Code Requirements for Structural Concrete” with amendments per 2022 California Building Code, Chapter 19A, Section 1905A.
3. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Mockups: Cast concrete slabs-on-grade panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, colors and standard of workmanship for polished, colored and clear sealed concrete slab finishes.

1. Build panel approximately 250 sq. ft. for slab-on-grade mockup in the location indicated or, if not indicated, as directed by Architect, and as specified in Division 03 Section “Polished Concrete Finishing”.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:

    a. Special inspection and testing and inspecting agency procedures for field quality control.
    b. Construction joints, control joints, isolation joints, joint-filler strips, and semirigid joint fillers.
    c. Vapor-retarder installation.
    d. Steel reinforcement installation.
    e. Anchor rod and anchorage device installation tolerances.
    f. Cold and hot weather concreting procedures.
    g. Concrete finishes and finishing.
    h. Curing procedures.
    i. Forms and form-removal limitations.
    j. Shoring and reshoring procedures.
    k. Methods for achieving specified floor and slab flatness and levelness.
    l. Floor and slab flatness and levelness measurements.
    m. Concrete repair procedures.
    n. Concrete protection.
    o. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
    p. Protection of field cured field test cylinders.
    q. Concrete mixtures, finishing, and curing of slabs to receive a polished finish.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

    1. Identification: Bundle and tag reinforcing steel with grades and suitable identification marks for checking, sorting and placing. Use waterproof tags and markings and do not remove until steel is in place.

1.7 COORDINATION

A. Slab Finishes: Coordinate slab finish requirements with trades installing or applying floor finishes or treatments over slabs. Finishes shall include but not be limited to concrete sealing, topical concrete vapor control barrier, ceramic tile, resinous/fluid applied floor systems, adhered resilient floor systems, and adhered carpet.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Earth Forms: Use for sides of footings only where soil is firm and stable and concrete will not be exposed. Where earth forms are used, cut excavations neat and accurate to size for placing concrete directly against the excavation.

B. Rough-Formed Finished Concrete: Use for formed concrete that will not be exposed in the finished work, fabricate forms of plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Smooth-Formed Finished Concrete: Use for formed concrete that will be exposed in the finished work, fabricate forms of form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Preformed reusable liners where indicated for horizontal board pattern/texture.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Dual-Grade reinforcing bars: ASTM A615 & A706, Grade 60.

D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

E. Plain-Steel Welded Wire Reinforcement: ASTM A1064, plain, fabricated from as-drawn steel wire into flat sheets.

F. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. Slabs on Grade and Foundations: Use precast concrete blocks, plastic-coated steel with bearing plates or specifically designed wire-fabric supports fabricated of plastic. Precast blocks shall be not less than 3 inches by 3 inches square and shall have a compressive strength equal to or greater than the strength of the surrounding concrete.
2. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

H. Fabricating Reinforcement: Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice" or ACI SP-66 and the details shown on the Drawings.

1. In the case of fabricating errors, do not rebend or straighten reinforcement in a manner that will damage or weaken the material.
2. Bends shall be made cold using pin sizes as recommended ACI 318 as modified by T24, CCR, Part 2.
3. Unacceptable Work: Reinforcement with any of the following defects will not be permitted:

    a. Bar lengths, depths, and bends exceeding specified fabrication tolerance.
    b. Bends or kinks not indicated on the project Drawings or the final Shop Drawings.
    c. Bars with reduced cross-section due to excessive rusting or other cause.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type II, gray.

2. Fly Ash: ASTM C 618, Class F. The use of a quality fly ash will be permitted as a cement-reducing admixture up to a maximum of 15% of the weight of portland-cement. Limit fly ash to 10% maximum for concrete floor slabs to be polished or stained.

3. Blended hydraulic cement: ASTM C595/C595M, type IL, Portland lime stone cement.

B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Where concrete expansion from alkali silica or alkali carbonate reactions is anticipated, provide aggregate with documented service record data of at least

10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

2. Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as the combination of sizes when two or more are used, shall conform to the grading requirements of ASTM C33.
3. Coarse aggregate: Coarse aggregate shall consist of a clean, hard, fine grained, sound crushed rock, or washed gravel or a combination of both. It shall be free from oil, organic matter, or other deleterious substances. Aggregate shall be uniformly graded from one-quarter inch size to maximum size.
4. The maximum size of aggregates used in the project shall be consistent with the dimensions and form of the section being placed, the location and spacing of the reinforcing bars, and with the method of compaction, and shall be such as will produce dense and uniform concrete free from rock pockets, honey-comb and other irregularities. The nominal maximum size of the aggregate shall not be more than one-fifth the narrowest dimension between forms, one-third the depth of slabs nor three-fourths the minimum clear spacing between reinforcing bars.
5. Combined Grading: The combined grading shall be such that the percentage by weight of the combined aggregates shall fall within the limits established as follows:

Sieve number or size in inches (maximum)	Percentage by Weight		
	1-1/2”	1”	3/4”
Passing a 2 inch	---	---	---
Passing a 1-1/2 inch	95-100	---	---
Passing a 1 inch	70-90	90-100	---
Passing a 3/4 inch	50-80	70-95	90-100
Passing a 3/8 inch	40-60	45-70	55-75
Passing a No. 4	35-55	35-55	40-60
Passing a No. 8	25-40	27-45	30-46
Passing a No. 16	16-34	20-38	23-40
Passing a No. 30	12-25	12-27	13-28
Passing a No. 50	2-12	5-15	5-15
Passing a No. 100	0-3	0-5	0-5

6. Special grading or size limitations: When reviewed and approved by the Architect, other gradings or maximum size limitations may be used if mixes are designed and tested in accordance with the concrete mixture specified in the “Concrete Mixtures” Article.
7. Soundness of Aggregates: Both the coarse and fine aggregate shall be tested by the use of a solution of sodium or magnesium sulfate, or both, whenever in the judgment of the Architect, such tests are necessary to determine the quality of the material. Such tests shall be performed in accordance with ASTM C88 and the results shall show compliance with the limits set forth in ASTM C33.
8. Reactivity: Aggregates shall be free from any substance which may be deleteriously reactive with the alkalies in the cement in an amount sufficient to cause excessive expansion of the concrete or which will interfere with normal hydration of the cement. Acceptability of the aggregate shall be based upon satisfactory evidence that the aggregate is free from such materials.

9. Aggregates shall be tested, when required by the Architect prior to the concrete mix being established, in accordance with the following specifications:

Test	Specification
Abrasion	ASTM C131 and C535
Gradation	ASTM C136
Alkali Reactivity	ASTM C289 and C227
Organic Impurities	ASTM C40
Clay Lumps	ASTM C142

10. Maximum Coarse-Aggregate Size: Nominal size as indicated on Drawings.
11. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Admixtures shall be reviewed and approved by the Architect.

B. Admixtures for concrete slabs to receive a stain or sealed finish shall be coordinated with and approved by the stain/sealer manufacturer and applicator.

C. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Certification of requirements and chloride ion content is required from the admixture manufacturer prior to mix design review.

1. Air-entraining Admixture: ASTM C260.

    a. Available Products: Subject to compliance with requirements, provide one of the following products:

        1) Euclid Chemical Company (The); Air Mix.
        2) BASF/Master Builders, Inc.; Micro-Air.
        3) Sika Corporation; Sika AER.

2. Water-reducing Admixtures: ASTM C494 Type A.

    a. Available Products: Subject to compliance with requirements, provide one of the following products:

        1) Euclid Chemical Company (The); Eucon WR-75.
        2) BASF/Master Builders Inc.; Pozzolith 220N.
        3) Sika Corporation; Plastocrete 161.

3. Water-reducing, Retarding Admixtures: ASTM C494 Type D.

a. Available Products: Subject to compliance with requirements, provide one of the following products:

1) Euclid Chemical Company (The); Eucon Retarder-75.
2) BASF/Master Builders Inc.; Pozzolith 300 R.
3) Sika Corporation; Plastiment.

4. High Range Water-Reducing Admixture (HRWR): ASTM C494 type F or G.

a. Available Products: Subject to compliance with requirements, provide one of the following products:

1) Euclid Chemical Company (The); Eucon 37.
2) BASF/Master Builders Inc.; Rheobuild 1000.
3) Sika Corporation; Sikament 300.

b. When more than 30 minutes is required between the addition of admixtures to final placement of the concrete, a combination of water-reducing, set controlling admixtures (ASTM C494, Types A, D and E) may be used.

5. Non-Corrosive, Non-Chloride Accelerator: ASTM C494 Type C or E.

a. Available Products: Subject to compliance with requirements, provide one of the following products:

1) Euclid Chemical Company (The); Accelguard 80.
2) BASF/Master Builders Inc.; Pozzutec 20+.
3) Sika Corporation, Plastocrete 161FL.

b. The admixture manufacturer shall have long-term (more than one year duration) non-corrosive test data on metal deck and reinforcing steel from an independent testing laboratory using an acceptable accelerated corrosion test method such as using electrical potential measures.

2.5 CURING AND SEALING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Do not use curing and sealing compounds at polished concrete slabs. Curing of concrete slabs that are to receive a polished finish shall be coordinated with Division 03 Section “Polished Concrete Finishing”.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Confilm.
b. ChemMasters; SprayFilm.
c. Conspec by Dayton Superior; Aquafilm.
d. Dayton Superior Corporation; Sure Film (J-74).
e. Edoco by Dayton Superior; BurkeFilm.
f. Euclid Chemical Company (The), an RPM company; Eucobar.
g. Lambert Corporation; LAMBCO Skin.

h. L&M Construction Chemicals, Inc.; E-CON.
i. Meadows, W. R., Inc.; EVAPRE.
j. Sika Corporation; SikaFilm.
k. Symons by Dayton Superior; Finishing Aid.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, clear or white polyethylene film, 6 mil minimum thickness, or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating (Not for use at slabs to receive a polished finish).

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Kure 200.
b. ChemMasters; Safe-Cure Clear.
c. Conspec by Dayton Superior; W.B. Resin Cure.
d. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
e. Edoco by Dayton Superior; Res X Cure WB.
f. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
g. L&M Construction Chemicals, Inc.; L&M Cure R.
h. Meadows, W. R., Inc.; 1100-CLEAR.
i. Symons by Dayton Superior; Resi-Chem Clear.

2. Curing compounds are subject to removal after curing period has elapsed; refer to Part 3 Article “Concrete Protecting and Curing.”

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A (Not for use at slabs to receive a polished finish).

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Kure 1315.
b. ChemMasters; Polyseal WB.
c. Conspec by Dayton Superior; Sealcure 1315 WB.
d. Edoco by Dayton Superior; Cureseal 1315 WB.
e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
f. Meadows, W. R., Inc.; Vocomp-30.
g. Symons by Dayton Superior; Cure & Seal 31 Percent E.

2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: As specified in Division 07 Section “Underslab Vapor Retarder,” ASTM E 1745, Class A, 15 mil thickness minimum.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

1. Type V, load bearing, for bonding freshly mixed concrete to hardened concrete.

2.8 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.9 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301, ACI 318 Chapter 26; and Chapter 19A of the California Building Code.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

a. The testing agency used for preparing mixture designs shall be different from the testing agency retained by the Owner for testing concrete strength and materials.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 15 percent.

a. limit fly ash to 10% maximum for concrete floor slabs to be polished.

C. Limit water-soluble, chloride-ion content in hardened concrete to the following percentages by weight of cement.
1. Reinforced concrete exposed to chloride in service: 0.15 percent.
2. Reinforced concrete that will be dry or protected from moisture in service: 1.00 percent.
3. Other reinforced concrete: 0.30 percent.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as indicated on Drawings for strength, slump, water/cement ratio, and maximum aggregate size.

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Project site mixing of structural concrete will not be permitted. Project site mixing of concrete for other purposes may be permitted only when reviewed and approved by the Architect. When allowed, measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ACI 318. Mix concrete materials in appropriate drum-type batch machine mixer, the capacity of the mixer shall be such that it will handle one or more full sack batches.

C. Control of Admixtures:

1. Admixtures shall be charged into the mixer as solutions and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer.
2. If two or more admixtures are used in the concrete, they shall be added separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete.
3. Addition of retarding admixtures shall be completed within 1 minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first.
4. Admixtures shall be used in accordance with the manufacturer's instructions.

D. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall not be retempered, but shall be discarded.

E. When concrete arrives at the project with slump below that suitable for placing, as indicated by the specifications, water may be added only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

1. Where earth is used for forming sides of footings, increase the width of footings by 1 inch on each side of the footing.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

B. Conduits and Pipes Embedded in Concrete:

1. Pipes, other than conduits for electrical circuits, shall not be embedded in structural concrete unless specifically reviewed and approved by the Architect and the Division of the State Architect. Any pipe or conduit may pass through any walls or floor slab by means of a sleeve so located that it does not impair the

strength of the structure. Openings larger than 12 inches in any dimension shall be as detailed on the structural plans.

2. Unless otherwise approved, embedded pipes or conduits, other than those merely passing through, shall be not larger in outside dimension than one-third the thickness of the slab, wall, or beam in which they are embedded, nor shall they be spaced closer than three diameters or widths on center and shall have at least 1-1/2 inches concrete cover.
3. Sleeves, pipes, or conduits of aluminum shall not be embedded in structural concrete unless effectively coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete must be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Vapor retarders shall be installed in accordance with the requirements of Division 07 Section “Underslab Vapor Retarder.”

3.5 STEEL REINFORCEMENT

A. Quality Control: Reinforcement steel and placement shall be subject to inspection and testing per Part 3 Article “Field Quality Control.”

B. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Coordinate installation of steel reinforcement with installation of vapor barrier specified in Division 07 Section “Underslab Vapor Retarder.”
2. Do not cut or puncture vapor retarder; if cut or damaged, vapor barrier shall be repaired in accordance with Division 07 Section “Below Grade Vapor Retarder.”

C. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

    a. Use only grooved joints for concrete surfaces that will be permanently exposed to view.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

    a. Sawn joints shall not be used for concrete surfaces that will be permanently exposed to view.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONVEYING

A. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.

B. Conveying equipment shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:

1. Truck mixers, agitators and non-agitating units and their manner of operation shall conform to the applicable requirements of ASTM C94.
2. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. A suitable device shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.
3. Do not use reinforcement or reinforcement supports to support runways for concrete conveying equipment.

C. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

D. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete. The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 inches. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

1. Reposition any misaligned reinforcement.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 305 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not permanently exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces permanently exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Slab Finishes: Provide finished slab surfaces as indicated below; confirm and coordinate surface finishes for adhered and fluid applied floor finishes with trades installing/applying respective floor systems required for the project conditions.

1. Finishing of concrete floor slabs to receive a polished finish shall be coordinated with division 03 Section “Polished Concrete Finishing.”

	Finish Floor Application	Slab Finish Type
1.	Surfaces to receive mortar setting beds for tile flooring and similar applications.	Scratch Finish
2.	Surfaces to receive thinset tile flooring directly over concrete	Trowel and Fine Broom Finish

	Finish Floor Application	Slab Finish Type
3.	Surfaces to receive adhered carpet, resilient sheet, or resilient tile flooring	Trowel and Fine Broom Finish
4.	Surfaces to receive epoxy or polyurethane fluid applied flooring	Light Broom Finish (Confirm with floor system manufacturer)
5.	Surfaces to be exposed and sealed concrete	Troweled Finish
6.	Ramped exposed concrete	Medium Broom Finish
7.	Surfaces to receive waterproof membranes	Floated Finish
8.	Surfaces to receive a polished finish; Coordinate with Division 03 Section “Polished Concrete Finishing.”	Smooth trowel finish, not burned

C. Slab Flatness (F_F) and Levelness (F_L): Provide finished slab flatness and levelness as indicated below; confirm and coordinate surface finishes for floor finishes with trades installing/applying respective floor systems required for the project conditions.

	Application		Flatness (F_F)	Levelness (F_L)
1.	Multi-Use Room (Assembly Space)	Overall: Local:	40 28	30 22
2.	Classrooms (Other than polished concrete floor areas)	Overall: Local:	30 24	25 15
3.	Slabs to receive polished concrete finish, Coordinate with Division 03 Section “Polished Concrete Finishing.”	Overall: Local:	50 40	30 20
4.	Slabs to receive resilient flooring	Overall: Local:	30 24	25 15
5.	Slabs to receive carpet flooring	Overall: Local:	25 17	20 15
6.	Other areas not specified	Overall: Local:	25 17	20 15

D. Sloped Slab Finishes: Where slabs are indicated to be sloped, finished slabs shall have a slope not to exceed 1/4 inch per one foot unless otherwise indicted on the Drawings.

E. Slab Finish Types: Slab finish types shall be as follows:

1. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
2. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing.
3. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Trowel and Fine-Broom Finish: After applying a trowel finish and while concrete is still plastic, slightly scarify surface with a fine broom to produce a fine directional finish.
5. Broom Finish: Immediately after float finishing, slightly roughen surface by brooming with fiber-bristle broom perpendicular to main traffic route and/or ramp surfaces. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces. Provide light broom finish where indicated on drawings parallel to tread nosings where concrete will remain exposed.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305 for hot-weather protection during curing.

B. Curing of Polished Concrete Floor Slabs; Curing and sealing compounds shall not be used on concrete floor slabs to receive a polished finish. Coordinate with Division 03 Section “Polished Concrete Finishing” for curing requirements.

C. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

E. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

F. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days using a water saturated absorptive cover kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

    a. This method shall not be used on floor slabs receiving adhered floor systems, fluid applied floor systems, or sealers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    b. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written

instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENTS

A. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling as long as possible and until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

a. Limit cut depth to 3/4 inch.
b. Make edges of cuts perpendicular to concrete surface.
c. Perimeters of cut areas shall be square or rectangular in shape with cuts vertical and horizontal.
d. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried.
e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the concrete construction to determine if they are of the quality specified.

C. Contractor Responsibilities:

1. The Contractor shall maintain control of the quality of materials and workmanship in order to conform with the drawings and specifications.
2. To facilitate testing and inspection, the Contractor shall:

a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
b. Provide access to the Work for the designated Testing and Inspection Agency.
c. Furnish all necessary materials and labor to assist the designated Testing and Inspection Agency in obtaining and handling samples at the project or other sources of materials.
d. Provide and maintain for the sole use of the Testing and Inspection Agency adequate facilities for safe storage and proper curing of concrete test specimens on the project site for the first 24 hr. as required by ASTM C31.

3. The Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Testing and Inspection Services:

1. Testing and inspections shall be performed by the designated Testing and Inspection Agency.
2. Testing and inspections shall be in accordance with the 2022 California Building Code, Section 1705A.3 and Table 1705A.3, DSA Statement of Structural Tests and Inspections form DSA 103, Structural Drawings Special Inspection Criteria, and shall include but not be limited to the following:

a. Inspection of steel reinforcement.
b. Inspection of headed bolts and studs prior and during concrete placement.
c. Verification of use of required design mixture.
d. Sampling of concrete for strength tests, slump, air content, and temperature of concrete at time of placement.
e. Inspection of concrete placement, including conveying and depositing.
f. Inspection of curing procedures and maintenance of curing temperature.

g. Verification of concrete strength before removal of shores and forms from beams and slabs.
h. Inspection of formwork.

E. Sampling and Testing of Steel Reinforcement:

1. Samples of reinforcing steel shall be taken by a designated approved testing agency at place of distribution prior to shipment or at project site.
2. Where samples are taken from bundles as delivered from the mill, with the bundles identified as to heat number and provided the mill analyses accompany the report, one tensile test and one bend test shall be made from a specimen from each 10 tons or fraction thereof of each size of reinforcing steel.

    a. Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each 2-1/2 tons or fraction thereof of each size of reinforcing steel.

3. Each sample shall consist of no fewer than two pieces, each 18 inches long, of each size and grade or reinforcing steel.

F. Batch Plant Inspection: The quality and quantity of materials used in transit mixed concrete and in batched aggregates shall be continuously inspected at the location where materials are measured by an approved Testing and Inspection Agency.

1. Waiver of Batch Plant Inspection: Batch plant inspection may be reduced to periodic under the following conditions (when approved through Part 1, Section 4.L):

    a. The concrete plant complies fully with the requirements of ASTM C94, Sections 8 and 9, and has a current certificate from the National Ready Mixed Concrete Association. The certification shall indicate that the plant has automatic batching and recording capabilities.
    b. The Testing Agency shall check the first batching at the start of work and furnish mix proportions to the licensed weighmaster.
    c. Licensed weighmaster shall positively identify materials as to quantity and certify to each load by a ticket.
    d. Tickets shall be transmitted to the Contractor by cement truck driver with load identified thereon. Do not accept loads without a load ticket identifying the mix; Contractor shall keep a daily record of placements identifying each truck, its load and time of receipt, and approximate location of deposit in the structure and will transmit a copy of the daily record to the Architect.
    e. At the end of the project, the weighmaster shall furnish an affidavit to the Architect certifying that all concrete furnished conforms in every particular to proportions established by mix designs.
    f. The Testing Agency shall certify and submit evidence of compliance to the governing agency Division of the State Architect and obtain governing agency’s approval prior for a waiver of batch plant inspection prior to mixing the concrete.

G. Placement Record: A record shall be kept on-site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion

of the structure and shall be open to the inspection of the governing agency (Division of the State Architect).

H. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture but not less than one sample for each 50 cu. yd. or fraction thereof and one sample for each 2,000 square feet of slab area.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure four standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at 7 days for information and two cured specimens at 28 days for strength acceptance, the fourth specimen shall be held in reserve in case additional testing in necessary.

    a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7 and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
11. Additional testing and inspecting will be performed to determine compliance of replaced or additional work with specified requirements.

    a. The cost of additional testing and inspection of replaced work will be paid for by the Owner with the amount being deducted from the Contract Amount by a Change Order.

3.17 PROTECTION OF SEALED FLOORS

A. Protect sealed floor surfaces from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by floor treatment installer.

END OF SECTION

SECTION 033543

POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Polished concrete finishing including liquid treatments, grinding, honing, scoring, and sealing.

B. Related Sections:

1. Division 03 Section "Cast-Place Concrete" for cast-in-place concrete slabs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product incorporated into the Work, include product data, application instructions and VOC content for liquid products.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

C. Samples for Initial Selection: For each type of product requiring color selection.

D. Samples for Verification: For each type of exposed color.

E. Field Quality Control Reports: for dynamic and static coefficient of friction test reports.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For instructions to include in maintenance documentation.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be trained and approved by polished concrete finishing system manufacturer and be experienced in performing work similar in design, products, and extent to the scope of this Project, with a record of successful in-service performance for not less than 3 years, and with sufficient production capability, facilities, and personnel to produce specified work.

1. A factory trained competent supervisor must be on site at all times during concrete polishing work is performed.

B. Walkway Auditor: Certified by CPAA or NFSI to test bonded abrasive polished concrete floors for dynamic and static coefficient of friction according to ANSI B 101.1 and B 101.3.

C. Mockup: Build mockup to verify selections made under submittals, to demonstrate aesthetic effects, typical joints, surface finish, tolerances, and to set quality standards for materials and execution. Mockup shall be removed following acceptance of completed work of this section. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockup of not less than 12 ft by 12 ft at a location acceptable to Architect.
2. Divide panel into four equal panels to demonstrate saw joint cutting.
3. Demonstrate curing, finishing, and protecting of polished concrete.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Require representatives of each entity directly concerned with polished concrete to attend, including the following:

a. Contractor's superintendent.
b. Ready-mix concrete manufacturer representative.
c. Cast-in-place concrete subcontractor.
d. Polished concrete finishing Subcontractor.

2. Review and discuss the following:

a. Cast-in-place concrete design mixture.
b. Concrete floor flatness (F_F) and levelness F_L) requirements.
c. Concrete placement.
d. Concrete finishing.
e. Curing procedures.
f. Construction joints.
g. Concrete repair procedures.
h. Protection of polished concrete.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity which complies with manufacturer’s written instructions.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply floor system within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply products to damp or wet substrates, when temperatures are below 65 deg F, or above 85 deg F.

B. Protection Prior to Polishing Concrete: Protect concrete floor areas to be polished as follows prior to finishing:

1. Prohibit use of markers, spray paint, and soapstone.
2. Prohibit improper application of liquid membrane film forming curing compounds.
3. Prohibit vehicle parking over concrete surfaces.
4. Prohibit pipe-cutting operations over concrete surfaces.
5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
6. Prohibit ferrous metals storage over concrete surfaces.
7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
8. Protect from acids and acidic detergents contacting concrete surfaces.
9. Protect from painting activities over concrete surfaces.

C. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F.

D. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

E. Close spaces to traffic during application and for not less than 24 hours after application unless manufacturer recommends a longer period.

F. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

1. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.10 COORDINATION

A. Coordinate requirements for concrete slab materials, mixes, finishing, and curing with Division 03 Section “Cast-in-Place Concrete.” Cast-in-Place Concrete to be polished shall comply with the following:

1. Portland Cement: ASTM C 150, Type I or Type II.
2. Aggregates: Uniformly graded mix of fine, intermediate, and large aggregates.
3. Strength: 3,500 psi minimum at 28 days.
4. Water-Cement Ratio: 0.45 maximum.
5. Slump: 4 inches +/- 1/2 inch.
6. Fly Ash Content: 10% maximum.
7. Admixtures: Admixtures containing more than 0.05% chloride ions are not permitted.
8. Concrete mix shall contain no fiber reinforcement.
9. Concrete shall not be air entrained.
10. Finish: Smooth trowel finish, not burned.
11. Curing: Do not use curing compounds.
12. Flatness and Levelness:

    a. Flatness: FF 50 (Average), FF 40 (Minimum local).
    b. Levelness: FL 30 (Average), FL 20 (Minimum local).

PART 2 - PRODUCTS

2.1 POLISHED CONCRETE FLOOR SYSTEM

A. Basis of Design: Design, Drawings, and Specifications for the polished concrete floor system are based on the following proprietary system:

1. Ultraflor Diamatic Polished Concrete Floor System.

    a. Subject to compliance with requirements, provide specified polished concrete floor system or submit a Substitution Request.

2.2 LIQUID FLOOR PRODUCTS

A. Material Compatibility: Provide liquid floor treatment materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Source Requirements: Obtain liquid floor treatment products from a single source from a single manufacturer.

C. VOC Content of Liquid Products: In compliance with the California Green Building Standards Code.

D. Liquid Densifier: Lithium densifier for use during grinding and polishing operations to penetrate into the concrete surface and react with the calcium hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete and is suitable for polished concrete surfaces.

1. Product: Ultraflor Diamatic Flor-Sil.

E. Wear Protection: Micro-impregnating nano lithium polymer wear protection finish for increased surface hardness and reflectivity on concrete surfaces.

1. Product: Ultraflor Diamatic Flor-Finish.

F. Colorant: Micronized waterborne translucent dye.

1. Product: Ultraflor Diamatic Flor-Color.
2. Color: As selected by Architect from manufacturer's standard colors.

G. Surface Cleaner: Water based surface cleaner as recommended by liquid floor treatment manufacturer.

H. Additional Liquid Floor Treatment Products: Products as recommended in writing by liquid floor treatment manufacturer and concrete polishing contractor.

2.3 ACCESSORY MATERIALS

A. General: Provide accessory materials as recommended in writing by liquid floor treatment product manufacturer and concrete polishing contractor.

B. Joint Filler: Two-component, chemical resistant, semi-rigid polyurea joint sealant.

1. Acceptable Product: The Euclid Chemical Company; EUCO QWIKjoint UVR (ultra violet resistant).

a. Color: As selected by Architect from manufacturers standard colors.

3. Hardness: Shore A, ASTM D 2240, 88 to 90.
4. Tensile Elongation: 200% to 250%, ASTM D 412.
5. Tensile Strength: 800 psi minimum, ASTM D 412.
6. Tensile Modulus: 600 to 675 psi, ASTM D 412

2.4 EQUIPMENT

A. Dry Grinding Equipment: If dry grinding, honing, or polishing; use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments to meet OSHA requirements.

B. Wet Grinding Equipment: If wet grinding, honing, or polishing; use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.

C. Field Grinding and Polishing Equipment: Proprietary grinding and polishing equipment as follows:

1. Planetary Grinder and Polisher:

    a. Diamatic BMG-780 or BMG-735.

2. Micro Polisher: Micro polisher/burnisher with weight and RPM capable of reaching a temperature of 100 degrees F for application of floor finish.

    a. Diamatic Micro Polisher MPS-1027E Burnisher.

3. Vacuums: Dust Collection must be designed for filtering of concrete dust. Minimum air speed of 300 CFM for Large and Medium Platform equipment.

    a. Diamatic BDC-3140LPP, BDC-1330LP.

4. Power generator capable of supplying a minimum output of 45kw and capable of generating 480/240 Volt three phase power.

D. Diamond Tooling: Proprietary abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc.) that are attached to rotating heads to refine the concrete substrate.

1. Manufacturer: Diamatic.
2. Metal Bond Tooling: Diamond tooling that contains industrial grade diamonds with a metallic bonded matrix that is attached to rotating heads to refine the concrete substrate and are typically used in the grinding and early honing stages of the polishing process.

    a. Metal Bonded Diamonds: 30/40 and 60/80 grit of soft, medium, and hard bonded metal; the hardness of concrete will determine the required hardness of the metal bonded diamonds as follows:

        1) Hard Concrete: Soft metal bonded diamonds.
        2) Medium Concrete: Medium metal bonded diamonds.
        3) Soft Concrete: Hard metal bonded diamonds.

3. Transitional Tooling: Diamond tooling that is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.

    a. Transitional Diamonds: #0, #1, #2 grit.

4. Resin Bond Tooling: Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, and thermoplastic-phenolic) that is attached to rotating heads to refine the concrete substrate. Resin bond tooling does not have the soft/medium/hard characteristics of metal bond tooling and are typically used for the later honing and polishing stages of the polishing process.

    a. Hybrid Flex-res Resin Bonded Diamonds: 50, 100, 200, 400, 800, 1,500, and 3,000 Grit.

5. Abrasive Pads: Abrasive pads resembling a typical floor maintenance burnishing pad that has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds.

    a. Diamond Impregnated Pads: Flor-Grit diamond impregnated pads, 200, 400, 800, 1,500 and 3,000 grit pads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of the Work.

B. Concrete Moisture Vapor Testing: Test concrete as follows:

1. Moisture Vapor Transmission: Test concrete for moisture vapor transmission according to methods indicated in ASTM F1869. Moisture vapor transmission rate shall not exceed more than 5 pounds per 1,000 square feet in 24 hours.
2. Relative Humidity: Test concrete for relative humidity using in situ probes according to ASTM F2170. Relative humidity shall not exceed 80%.

C. Proceed with installation only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Before applying finish system, clean and prepare substrates according to manufacturer's written instructions. Remove projections, fill voids, and seal joints if any, as recommended in writing by manufacturer. Repair concrete substrates to comply with requirements for concrete staining and polishing.

B. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

C. Mask adjoining surfaces not receiving coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent coating materials from entering substrate penetrations and clogging weep holes and drains.

D. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

E. Remove grease, oil, form release agents, paints, curing compounds, and other penetrating contaminants or film forming coatings from concrete.

F. Mechanically abrade concrete substrates by methods and with equipment recommended by floor system manufacturer. Grinding and polishing equipment shall be connected to a dust collection apparatus.

3.3 CONCRETE SUBSTRATE REPAIR

A. Cracks: Crack repair shall be completed after the first grinding and floor cleaning; comply with flooring system manufacturer's written instructions.

B. Spalls: Spall repair shall be completed after the first grinding and floor cleaning or prior to the beginning of the floor system process installation; comply with flooring system manufacturer's written instructions.

3.4 CUT AND POLISH LEVELS

A. Coefficient of Friction: Polished concrete floors shall achieve the following coefficient of friction values for level floor surfaces:

1. Static Coefficient of Friction: 0.5 minimum, ANSI B 101.1.

2. Floor surface shave be slip-resistant per CBC 11B-302.1

B. Cut Level: Cut to the following aggregate exposure level:

1. Aggregate Exposure: Class B, Fine/Sand Aggregate Finish. Surface exposure of 85 to 95% fine aggregate and 5 to 15% cement fines and coarse aggregate based on visual observation of the overall area of the polished floor.

C. Polish Level: Gloss readings are not to be obtained through the use of any microfilming products, sealers, coatings, enhancers or as the result of resin transfer from resin bond abrasives. Readings shall be taken not less than 10 feet on center in field areas and within 1 foot of floor area perimeters. In no case shall a reading be below 2% of specified minimum sheen. Polish to the following Gloss Level:

1. Level 3, medium gloss reading of 41 to 55, 800 grit diamond finish.

3.5 JOINT FILLING

A. Joint Filling: Prepare joints and install joint filling materials in accordance with joint filler manufacturer's recommendations.

1. Joints shall not be filled until slabs have cured not less than 30 days.
2. Joints shall be filled after the first grinding pass and floor cleaning before any subsequent grinding passes.
3. Joint Backing: Dried silca sand, 1/16 to 1/8 inch deep, at the bottom of joints to prevent three sided adhesion; do not use backer rod or other fill materials.
4. Fill joints full depth of the joint and in one pass. Overfill joints and shave joints flush with the surrounding joint edge. Shave joints after curing time period recommend by sealant manufacturer has passed.

3.6 GRINDING AND POLISHING

A. General: Use grinding and polishing steps and grits as recommended in writing by floor system manufacturer to achieve the desired level of cut and level of gloss and to match accepted mockup.

1. Perform all polishing procedures to ensure a consistent visual appearance from wall to wall.
2. Control and dispose of waste products produced by grinding and polishing operations.
3. Neutralize and clean polished floor surfaces.
4. Apply dyes, densifiers and finish treatments between grinding/polishing/burnishing operations and at rates recommended in writing by flooring system manufacturer.
5. Polished edge work shall be done with hand held or walk behind equipment and shall be finished to a level matching the field of the floor system.

B. Initial Grinding:

1. Use grinding equipment with metal or semi-metal bonded tooling.
2. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, limit change in grit values to not more than double the grit value of the previous pass.
4. Achieve maximum refinement with each pass before proceeding to finer grit tools.
5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
6. Continue grinding until aggregate surface exposure matches approved field mock-up.

C. Treating Surface Imperfections:

1. Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.
2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections, compared to mockup, are not reasonably noticeable when viewed from 20 feet away under lighting conditions that will be present after construction.

D. Grout Grinding:

1. Use grinding equipment and appropriate grit and bond diamond tooling.
2. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

E. Honing:

1. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
2. Use grinding equipment with hybrid or resin bonded tooling.
3. Hone concrete in one direction starting with 120/140 grit tooling and increasing to 200 grit making as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, reaching maximum refinement with each pass before proceeding to finer grit tooling.
4. Apply colorants and densifiers in accordance with liquid floor treatment manufacturer's written instructions.
5. Hone concrete in one direction with 400 grit tooling making as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, reaching maximum refinement with each pass before proceeding.

F. Polishing:

1. Use polishing equipment with resin-bonded tooling.
2. Begin polishing in one direction starting with 800 grit tooling.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of appearance has been achieved.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

6. Apply wear protection products in accordance with liquid floor treatment manufacturer’s written instructions. Final film thickness should be less than .05 mils after cure.
7. Achieve final polish using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

3.7 COLORING CONCRETE FLOORS

A. Colorant Application:

1. Auto scrub the surface completely clean and remove any remaining dust. Allow the surface to dry completely before application of colorant.
2. Apply using methods and techniques required by manufacturer to produce finish matching approved field mock-ups. Sequence installation with honing / polishing / burnishing and allow to dry in accordance with the manufacturer’s recommendations before proceeding. Apply dye immediately prior to final honing step, unless otherwise indicated by the manufacturer’s recommendations.
3. Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.
4. Maintain consistent saturation throughout application. Apply colorant to rejection.
5. Avoid splashing, dripping, or puddling of solution on adjacent substrates.
6. Remove all rejected dye from the surface using an auto scrubber.

3.8 FIELD QUALITY CONTROL

A. Testing: Provide field quality control testing confirming compliance with specified performance criteria.

1. Static Coefficient of Friction: The static coefficient of friction shall be tested and determined by certified an NFSI walkway auditor using the ANSI B-101 quality control test.

3.9 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of polished floor system.

1. Protect from spills and contamination.
2. Avoid moisture for not less than 72 hours after completion of floor finish system.
3. Limit pedestrian traffic for not less than24 hours after completion and not less than 7 days for other traffic.

B. Remove grinding dust from installation and adjacent areas. Clean surfaces according to manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that polished flooring is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 033910
TOPICAL CONCRETE VAPOR CONTROL BARRIER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface applied penetrating moisture barrier treatments for cured concrete slabs on grade and elevated concrete slabs on metal decking.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for concrete mixtures, placement, and finishing.
2. Division 09 Section "Flooring Moisture and Alkalinity Testing" for concrete slab moisture and alkalinity testing.
3. Division 09 Sections as applicable to adhered floor systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer’s specification data, installation instructions, and statement of VOC content.

B. Reports: Laboratory test reports.

C. Digital Photographs: Digital photography of completed installation, including surface preparation of concrete slabs.

D. Qualification Data: For qualified Applicator.

E. Field quality-control reports by manufacturer’s technical representative.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Limitations: Proceed with application only when existing and forecasted weather and substrate conditions permit product to be applied according to manufacturers' written instructions and warranty requirements.

1. Do not apply when concrete surface temperatures are below 40 degrees F or above 90 degrees F; concrete surface temperatures shall not exceed these limits prior, during and after application for 48 hours.
2. Do not apply products to unprotected surfaces or when water has accumulated on the surface of the concrete.
3. Allow continuous ventilation and indirect air movement during application and curing process.

1.6 COORDINATION

A. Coordinate with Work of the following Sections:

1. Division 03 Section “Cast-in-Place Concrete:”

a. Review concrete mixture design; water/cement ratio shall not exceed 0.44 for concrete slabs on grade.
b. Review finishing of concrete slabs; slabs shall be finished as specified by topical vapor control barrier manufacturer.

2. Division 07 Section “Underslab Vapor Retarder:” Concrete slabs-on-grade shall be poured directly over a vapor barrier complying with ASTM E1745, Class A requirements and having a permeance rating not exceeding 0.025 Perms per ASTM E96.
3. Division 09 Section “Flooring Moisture and Alkalinity Testing:” Review and coordinate preparation of concrete slabs on grade with testing requirements and preparation procedures.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree to repair or replace materials that fail to maintain requirements specified in "Performance Requirements" Article within specified warranty period.

1. In the event floor coverings are damaged due to failure of products or application of products specified in this Section and independent testing results verify water vapor emission and/or alkalinity values in excess of the limits specified, manufacturer and installer shall repair or replace barrier, floor coverings, wall base, adhesives, and patching compounds at no cost to Owner. Warranty shall not list upper moisture or alkalinity levels. Warranty shall not exclude cracks, concrete cohesive failure, ACI 318, ACI 201, dew point, concrete salts or silicates contamination.

B. Warranty Period: Fifteen (15) years from date of Substantial Completion.

C. Liability Insurance: Manufacturer shall provide product liability insurance in the amount of one million dollars ($1,000,000) per occurrence, listing Architect and Owner as additional insured. Sub-contractor general liability certificates are not acceptable.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. VOC Content of Floor Coatings and Primers: Floor coatings and primers must not exceed VOC content limits established by South Coast Air Quality Management District (SCAQMD) Rule 1113 Architectural Coating when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24).

1. Floor Coatings and Primers: 100 g/L.

2.2 TOPICAL CONCRETE VAPOR CONTROL BARRIERS FOR CURED CONCRETE

A. Description: Two-Component, spray applied product for application to newly poured concrete slabs on grade during final troweling process and designed to suppress water vapor emission, alkalinity, and relative humidity rates from concrete. Material shall be a polymer (non-silicate) based penetrating, film forming barrier that remains compatible with flooring adhesives.

1. Basis of Design: Drawings and specifications are based on the following:

a. Synthetics International; Synthetic 10TR.

1) Subject to compliance with requirements, provide the product indicated or an equivalent product subject to request for substitution.

2. Performance Requirements: Applied product systems shall meet performance requirements indicated without failure due to defective manufacture or installation.

a. Relative Humidity: Suppress 100 percent relative humidity in accordance with ASTM F2170.
b. Water Vapor Transmission Rate (WRT), ASTM E96:

1) Grains/sf/hour: 0.60 to 1.0 or less.
2) Pounds/1,000 sf/24 hours: 2.0 to 3.3 or less.
3) Grams/hour per square meter: 0.40 to 0.70 or less.

c. Water Vapor Permeance (WVP), ASTM E96:

1) Perm (inch-pound): 1.4 to 2.4.
2) Grams/Pa s m2 x 10 (-8): 8.1 to 13.6.
3) Nanograms/Pa s m2: 81.1 to 136.3.

d. Vapor Emission Testing, ASTM F 1869: Not more than 3 lbs.

e. Alkali Resistance, ASTM D1308: 100% resistant to 30 day exposure to 14 pH and 35% potassium hydroxide resistant.
f. Alkalinity Control: Suppress 14 pH without damage per ASTM F710.
g. Concrete Adhesion: 100% concrete cohesive failure in accordance with ASTM FD4541 pull-off adhesion tester.

3. Physical Properties:

a. Product Type: Water based.
b. Product Color: White, dries clear.
c. Solids Content: 37 percent by volume.
d. Thickness: 4 to 6 mills, WFT.
e. Material Mixture: Two-component.
f. Number of Coats: Two coat application.
g. Spread Rate: 250 to 350 square feet per gallon per coat.
h. Flooring Ready: 7 days.
i. Foot Traffic: 10 to 12 hours.
j. Product Odor: Slight odor.
k. Environmental: Non-corrosive, water based, water clean up product.
l. Product passes the California Department of Health Services Section 01650 Toxic VOC testing.
m. Product shall mix easily with concrete cement paste.
n. Product is not classified as a marine pollutant.
o. Product shall not contain hazardous air pollutants.
p. Volatile Organic Compounds (VOC) Content: 35 g/liter per EPA Method 24.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review approved concrete mix design and examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. Coordinate slab finish of new concrete slabs with Division 03 Section “Cast-in-Place Concrete.” New concrete slabs are to be finished with a light broom finish or prepared in accordance with requirements for existing concrete slabs.

3.3 APPLICATION, GENERAL

A. Manufacturer's Field Service Representative: Engage a factory-authorized service representative to inspect the substrate before application of surface treatment, to instruct Applicator on the product and application method to be used, and to supervise the product application.

B. Areas of Application: Apply topical concrete vapor control barrier to surfaces of concrete slabs-on-grade that are scheduled to receive adhered flooring products.

3.4 APPLICATION TO EXISTING CONCRETE

A. Preparation of Existing Concrete Slabs: Before application of surface treatment, clean substrate of substances that could impair penetration or performance of product according to manufacturer's written instructions and as follows:

1. Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents.
2. Use a high volume blower to remove surface sand and dirt and/or rinse with clean water to remove debris. Proceed with application when concrete surface is clean and dry.
3. Surfaces shall be clean and free of mud, dirt and contamination for other trades.
4. Shot blast floors to an ICRI # 4 using #420 shot and grind near edges.

B. Mix and apply product in accordance with manufacturer’s written installation instructions.

C. Crack and Joint Treatment: Seal all cracks and joints with product during initial application.

D. Apply topical concrete vapor control barrier by electric sprayer and/or roller, spread evenly over entire substrate, cracks, joints and penetrations by flat squeegee and back roll with lint free nap roller.

1. Apply two coats at a spread rate of 250 sf/gallon per coat.

E. Apply manufacturer’s approved primer and a nominal 1/8 inch cementitious topcoat over all barrier surfaces.

1. Cementitious topcoat is required for warranty extension for future flooring updates by Owner.

F. Protect from walking traffic for 12 hours and heavy traffic for 36 hours.

3.5 FIELD QUALITY CONTROL

A. Building shall be acclimated to the working environment of the Owner for not less than 2 weeks prior to field quality control testing.

B. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and prepare test reports directly on control barriers surface.

C. Testing shall be as specified in Division 09 Section “Flooring Moisture and Alkalinity Testing.” Testing shall be performed after curing of concrete and vapor control system, and shall include the following tests:

1. Moisture vapor emission, ASTM F 1869.

2. Relative Humidity, ASTM F 2170.
3. Alkalinity-pH, ASTM F710.

D. Prior to testing, do not sand or grind concrete surfaces that have applied topical concrete vapor control barriers.

E. Test results shall be forwarded to the manufacturer for warranty registration.

F. Treated areas having a vapor emissions rate exceeding flooring product requirements for moisture and pH-Alkalinity shall be resealed at no additional cost to the owner.

3.6 CLEANING, PROTECTION, AND REPAIR

A. Immediately clean product from adjoining surfaces and surfaces soiled or damaged by application as work progresses. Correct damage to work of other trades caused by application.

B. Comply with manufacturer's written cleaning instructions.

C. Do not allow foot or wheel traffic after application for time periods recommended in writing by manufacturer.

D. Repair areas damaged during construction to allow a curing time of approximately 5 days prior to installing floor coverings.

END OF SECTION

SECTION 042200

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Reinforcing steel.
5. Miscellaneous masonry accessories.

B. Related Sections include the following:

1. Division 03 Section “Post Installed Concrete and Masonry Anchors” for post installed anchors used in masonry.
2. Division 03 Section “Cast-in-Place Concrete” for footings for masonry walls.
3. Division 09 Section “Painting” for water repellents or paint applied to unit masonry assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

C. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.

b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780 for mortar mixes required to comply with property specification.
2. Include test reports, per ASTM C 1019 for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Table 2 in TMS 602.

1.4 QUALITY ASSURANCE

A. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Sections applicable to project meetings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.

1. Determine net-area compressive strength (f'm) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Table 2 in TMS 602.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.4 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for units exposed to the exterior.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

a. Products: Subject to compliance with requirements, provide one of the following:

1) ACM Chemistries; RainBloc.
2) BASF Construction Chemicals – Construction Systems; MasterPel 240.
3) Grace Construction Products; W.R. Grace & Co.; Dry-Block.

C. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2,000 psi.

2. Density Classification: Medium weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

    a. 8 x 8 x 16 inch nominal, 7 5/8 x 7 5/8 x 15 5/8 inch actual.

4. Exposed Faces: Precision face, or scored face units where indicated on drawings for nominal 8 x 8 inch face pattern.
5. Color: Manufacturer's standard gray.

D. Decorative Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2,000 psi.
2. Weight Classification: Medium weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

    a. 8 x 8 x 16 inch nominal, 7 5/8 x 7 5/8 x 15 5/8 inch actual.

4. Pattern and Texture:

    a. Standard pattern, split face finish where indicated on drawings.

5. Colors: Manufacturer's standard gray.

2.5 LINTELS

A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Blended Hydraulic Cement: ASTM C595/C595M, Type IL, portland-limestone cement.

E. Masonry Cement: ASTM C 91.

F. Mortar Cement: ASTM C 1329.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Davis Colors; True Tone Mortar Colors, gray.
    b. Approved equivalent.

H. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

I. Aggregate for Grout: ASTM C 404.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent; admixture shall be the same product used for the manufacturer of integral water repellant concrete masonry units, confirm product used with concrete masonry unit manufacturer.

K. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 and as indicated on the Drawings.

2.8 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of shape and dimensions indicated.

B. Postinstalled Anchors: Provide anchors per Division 03 Section “Post Installed Anchors” and as indicated on Drawings.

1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide one of the following:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.
    d. Approved equivalent.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement, mortar cement, and lime.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide Type S mortar unless another type is indicated or needed to provide required compressive strength of masonry. Refer Structural Drawings for additional requirements.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
2. Mix to match Architect's sample.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.

F. Grout for Unit Masonry: Grout shall comply with Article 2.2 of The Masonry Society (TMS) 602.

1. Use course grout complying with CBC Section 2103A.3.1.
2. Provide grout with a slump of 8 to 10 inches as measured according to ASTM C 143/C 143M or with slump as indicated on Drawings.

2.12 SOURCE QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. Concrete Masonry Unit Test: For each type of unit furnished, test per ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.

4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

D. Any mortar joints that are cracked or not bonded with the face shells of the CMUs are to be removed and joints repointed prior to grout placement.

3.6 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

1. Locate joints as indicated on Drawings.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.7 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Masonry Construction: Comply with requirements of 2022 CBC Section 2104A.1, 2104A.1.3, 2104A.1.3.11, and with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 and 2022 CBC Section 2104A.1.3 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 48 inches.
3. High lift grouting shall only be allowed with prior written approval by the enforcing agency.

3.8 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the masonry construction to determine if they are of the quality specified.

C. Contractor Responsibilities:

1. The Contractor shall maintain control of the quality of materials and workmanship in order to conform with the drawings and specifications.
2. To facilitate testing and inspection, the Contractor shall:

    a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
    b. Provide access to the Work for the designated Testing and Inspection Agency.
    c. Furnish all necessary materials and labor to assist the designated Testing and Inspection Agency in obtaining and handling samples at the project or other sources of materials.
    d. Provide and maintain for the sole use of the Testing and Inspection Agency adequate facilities for safe storage and proper curing of test specimens on the project site.

3. The Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Testing and Inspection Services:

1. Testing and inspections shall be in accordance with the 2022 California Building Code, Section 1705A.4, TMS 402-16 Level 2, TMS 602-16 Tables 3 & 4, and DSA Testing and Inspections form DSA 103.
2. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
3. Place grout only after inspectors has verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
4. Place grout only after inspectors have verified proportions of site-prepared grout.

E. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

F. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

G. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

I. Additional testing and inspecting will be performed to determine compliance of replaced or additional work with specified requirements.

1. The cost of additional testing and inspection of replaced work will be paid for by the Owner with the amount being deducted from the Contract Amount by a Change Order.

3.9 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.10 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site and recycle or legally dispose of off Owner’s property.

END OF SECTION

SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural steel, including exposed-to-view steel framing to receive special attention for AESS compliance as indicted in Division 05 Section “Architecturally Exposed Structural Steel Framing”.
2. Shrink resistant grout.

B. Related Sections:

1. Division 01 Section “Quality and Testing Requirements” for administrative and procedural requirements for quality assurance including independent testing requirements.
2. Division 05 Section "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
3. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
4. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
5. Division 05 Section "Metal Stairs" for steel stairs.

1.3 REFERENCED CODES AND STANDARDS

A. Comply with applicable provisions of the following specifications and documents:

1. California Code of Regulations, Title 24, Part 2, California Building Code, 2022 Edition.
2. American Institute of Steel Construction (AISC) Publications:

a. ANSI/AISC 303-16, Code of Standard Practice for Steel Buildings and Bridges.
b. ANSI/AISC 341-16, Seismic Provisions for Structural Steel Buildings.
c. ANSI/AISC 360-16, Specification for Structural Steel Buildings.
d. Quality Criteria and Inspection Standards, latest Edition.
e. Manual of Steel Construction, 15th Edition.

f. ANSI/AISC 358-16, Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications.

3. American Welding Society (AWS):

a. D1.1-15 Structural Welding Code - Steel.
b. D1.8-16 Structural Welding Code – Seismic Supplement.

4. Steel Structures Painting Council (SSPC):

a. Steel Structures Painting Manual, Vol. 2, Systems and Specifications, latest edition.

5. Federal Specifications:

a. FF-W-84A, Washers, Lock (Spring).

6. Research Council on Structural Connections (RCSC): Specification for Structural Joints Using High Strength Bolts.

a. ASTM C 1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink Grouts).
b. ASTM F3125/3125M, Standard Specification for High Strength Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

C. Qualification Data: For fabricator and installer.

D. Welding certificates.

E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

F. Certified mill test reports for structural steel, including chemical and physical properties.

G. Source quality-control reports.

H. Affidavit signed by the fabricator stating the structural steel furnished meets the requirements of the grade specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who employs adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. The Fabricator shall have completed a project of similar size and scope, and shall have adequate facilities, personnel, and equipment to meet production and quality requirements to maintain proper job progress.

B. Installer Qualifications: A qualified installer who employs adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

C. Contractor Qualifications: The Contractor shall have completed a project of similar scope and shall have adequate facilities, personnel, and equipment to meet production and quality requirements to maintain proper job progress.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel" and AWS D1.8/D1.8M, “Structural Welding Code – Seismic Supplement.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting fasteners after lubrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Identification of Structural Steel: The fabricator shall maintain the identity of the material and shall maintain suitable procedures and records attesting that the specified grade has been furnished, in compliance with AISC 360 and 2022 CBC Section 2202A.1.

1. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.

    a. Mill markings may be covered by shop priming provided the fabricator provides identification mark over the primer that can be traced through documentation.

B. W-Shapes: ASTM A 992.

1. For shapes that are part of the lateral force resisting system with flange thickness exceeding 1-1/2 inches and other shapes with flange thickness exceeding 2 inches, conform to the Supplementary Requirements of ASTM A6.

    a. S30, Charpy V-Notch Impact Test for structural shapes: Alternate core location. Test to minimum average value of toughness of 20 ft-lb at 70°F.

C. Plate, Bar, Channels, and Angles: ASTM A 36 (A572 when specified).

1. For plate 2 inches and thicker, conform to the Supplementary Requirements of ASTM A6.

    a. S5, Charpy V-Notch Impact Test. Test to minimum average value of toughness of 20 ft-lb at 70°F.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: Standard unless otherwise indicated on Drawings.
2. Finish: Black except where indicated to be galvanized.

F. Steel Castings: ASTM A216/A216M, Grade WCB, with supplementary requirement S11.

G. Steel Forgings: ASTM A668/A668M.

H. Welding Electrodes: Comply with AWS requirements, electrodes shall be compatible with the base material being welded. For welds designated as demand critical as part of the lateral force resisting system, filler metal shall have Charpy V-Notch rating per AISC 341. For filler metals used in combination with filler metals of different processes, provide certification of Charpy V-Notch compatibility per AISC 341 and AWS D1.8.

1. Shielded Metal Arc Welding: AWS A5.1, E70XX.
2. Self-Shielded flux core - NR 233.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. General: Provide hot dip zinc coated fasteners for exterior locations.

B. Bolts and Nuts:

1. General Use: Regular hexagon head type, ASTM A307, Grade A.
2. High Strength: Where high strength bolting is noted on drawings, bolts and nuts shall conform to following:

a. Bolts: ASTM F3125, A325 typical & A490 slip-critical.
b. Nuts: ASTM C563.

C. Anchor Rods, Anchor Bolts, and Nuts:

1. General Use: ASTM F1554, Grade 36 (36ksi).
2. High Strength: ASTM F1554, Grade 55 (55ksi) with Supplementary Requirement No. 1 or Grade 105 (105ksi) where specified.
3. Provide color coding per ASTM F1554 at each exposed end of anchor rods.

D. Washers: Washers shall be suitable for use intended and as follows:

1. Circular washers shall be flat and smooth and conform to the requirements of ANSI B18.22.1, Type A.
2. Washers for high strength bolts shall conform to ASTM F436.
3. Plate Washers shall conform to the requirements of ASTM A36
4. Beveled washers for American Standard beams and channels shall be square or rectangular, shall taper in thickness and shall be smooth.
5. Lock washers shall conform to FF-W-84.

E. Welded Studs, Connectors, and Anchors: ASTM A 108, Grades 1015 through 1020, AWS D1.1.

1. Threaded Studs: Nelson type CPL threaded studs.
2. Shear Connectors: Nelson type S3L shear connector studs.
3. Deformed bar anchors: Nelson D2L deformed bar anchors.

4. Concrete Anchors: Nelson H4L concrete anchors.

2.3 FORGED-STEEL STRUCTURAL HARDWARE

A. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, AISI C-1035.

B. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, AISI C-1030.

2.4 PRIMER

A. Steel Primer: Fabricator's standard lead and chromate free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer:

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: ASTM A780/A780M.

2.5 SHRINK RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time, and having the following characteristics:

1. Be capable of producing a flowable grouting material having no drying shrinkage or settlement at any age.
2. Compressive strength of grout (2 inch cubes) shall be not less than 5,000 psi at age seven days and 7,500 psi at age 28 days.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303 "Code of Standard Practice for Steel Buildings and Bridges," AISC 360 “Specification for Structural Steel Buildings,” and AISC 341 “Seismic Provisions for Structural Steel Buildings including Supplement No. 1.”

1. Camber structural-steel members where indicated.

    a. Camber horizontal members in accordance with AISC 360 Spec. Section M2. Do not use purely mechanical means to reverse over cambered beams.

2. Fabricate beams with rolling camber up.
3. Maintain structural steel identification markings until structural steel has been erected. Mill markings may be covered by shop priming provided the fabricator

provides identification mark over the primer that can be traced through documentation.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
2. Thermal cutting will be permitted only with the specific approval of the Architect.
3. Stresses shall not be transmitted through thermally cut surfaces unless such surfaces are cut by a mechanically guided torch.
4. The radius of re-entrant flame cut fillets shall be as large as possible, but never less than one-half inch.
5. All Thermal cutting shall be smooth and regular in contour per AWS.
6. The net area of thermally cut members shall be determined by deducting one-eighth inch from the cut edges not made by a mechanically guided torch.

C. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill or punch holes perpendicular to steel surfaces, do not thermally cut bolt holes or enlarge holes by burning.
2. Remove outside burrs resulting from drilling or reaming operations with a tool making a 1/16 inch radius.
3. Make bolt holes 1/16 inch oversize typical. Anchor bolt holes in column base plates shall be oversized per drawings.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Welded Construction:

1. The location and type of all welds shall be as shown on the drawings. No weld splices shall be made except as shown.
2. All welds shall be made by the electric shielded arc or the submerged-arc methods. The welding sequence and technique of welding shall be carefully controlled to minimize locked-up stresses and distortion.
3. Visible welded joints shall be considered "finished" welds and shall be carefully executed to preclude the necessity of grinding or otherwise finishing. However, when the appearance of the weld is unacceptable, in the opinion of the Architect, grinding shall be of the highest standard for both field and shop practice.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with the following:

1. Remove oil, grease, and similar contaminants in accordance with SSPC-SP-1.
2. Clean off heavy rust and loose mill scale in accordance with SSPC-SP-2.

G. Welded Threaded Studs, Shear Connectors, and Concrete Anchors: Prepare steel surfaces and automatically end weld studs and concrete anchors in accordance with AWS D1.1/D1.1M and the manufacturer's recommendations in such a manner as to provide complete fusion between the end of the stud and the plate. There should be no porosity or evidence of lack of fusion between the welded end of the stud and the plate. The stud shall decrease in length during welding approximately 1/8 inch for studs up to 5/8 inch in diameter, and approximately 3/16" in length for studs over 5/8 inch diameter.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified. Each member of the bolting crew applying high strength bolts shall be assigned an identification mark or symbol which shall be applied to each joint worked.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work. In addition, comply with AWS D1.8/D1.8M for “High Seismic Applications” as defined in AISC 360 where applicable.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

A. Maintain structural steel identification markings until structural steel has been erected. Mill markings may be covered by shop priming provided the fabricator provides identification mark over the primer that can be traced through documentation.

B. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces unless indicated to be painted.

C. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. Remove oil, grease, and similar contaminants in accordance with SSPC-SP-1.
2. Clean off heavy rust and loose mill scale in accordance with SSPC-SP-2 "Hand Tool Cleaning," or SSPC-SP-3 "Power Tool Cleaning."

D. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.

E. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize structural steel framing members that are exposed to the exterior and not located within the exterior walls of the building envelope.

2.10 SOURCE QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Provide testing and inspecting agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Testing and inspection agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Testing and Inspection Services: The following tests and inspections shall be performed by the designated laboratory.

1. Steel Testing: All steel used for structural purposes shall be identified as required by CBC Section 2202A.1. Manufacturer’s mill analyses and test reports are acceptable for properly identified steel, but the enforcement agency may require additional testing to determine the quality of the steel if there is any doubt as to its acceptability. Any steel not properly identified shall be tested to meet the minimum chemical and mechanical requirements of the ASTM standard appropriate for the steel specified for the structure.

a. Fabrication shall not commence until steel members designated on the Structural Testing and Inspection Schedule have been tested. Tests shall be made by an independent testing laboratory approved by the Architect. Reports certifying that the materials and workmanship conform to the contract documents shall be submitted to the Architect and the Division of the State Architect.

2. Inspection of Welding: Shop welding operations including the installation of automatic end-welded stud shear connectors shall be inspected by a certified Welding Inspector meeting the requirements of AWS QC1. The Fabricator shall schedule their operations to provide a minimum of 24 hours notice to the welding inspector so that all welding operations may be inspected.

   a. The Welding Inspector shall make a systematic record of all welds; recording shall include the following:

      1) Names and identification marks of welders.
      2) List of defective welds.
      3) Manner of correction of defects.

   b. The Welding Inspector shall check the material, equipment, procedure, welds, and the ability of each welder.
   c. Acceptance criteria shall be based on statically loaded connections. Upon detection of a rejectable weld, the inspector shall notify the Contractor, and observe removal of defects and repairs.
   d. The welding inspector shall tag or stamp accepted weldments with the inspector's identification stamp.
   e. A report stating that the welding they are required to inspect, is proper and has been done in conformity with approved drawings and specifications shall be furnished to the Architect.
   f. Welding inspections, testing and frequency shall conform to AWS D1.1, AWS D1.8 and related AISC documents. The Welding Inspector shall use all means necessary to determine the quality of the welds. However, the following tests and inspections shall be performed as a minimum:

      1) Visual Inspection of Welding:

         a) Observe multi-pass and full penetration welds continuously (i.e. the welding inspector shall be present at all times).
         b) Observe single pass fillet welds periodically. The inspector shall check the qualifications of the welders at the start of the work and then make final inspection of all welds for compliance prior to completion of welding.
         c) After the welding is completed, Contractor shall hand or power nylon brush welds, and thoroughly clean them before inspection.
         d) Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size; and insufficient throat and concavity.

e) Inspect the preparation of groove welds for adequate throat opening and for snug positioning of back-up bars.
f) Check the type and size of electrodes to be used for the various joints and positions. Check the storage facilities to see if they are adequate to keep the electrodes dry.
g) Verify the use of proper pre-heat and interpass temperatures.
h) Observe the technique of each welder periodically with the use of a welding inspection shield.

2) Nondestructive Testing of Welding:

a) Welds shall be non-destructive tested by one of the following methods in accordance with AWS D1.1 and AWS D1.8 at testing agency's option or as required by AWS or AISC at the frequency noted below:

Test Method	Frequency
Liquid Dye Penetrant Testing ASTM E165	When requested by Architect.
Magnetic Particle Testing ASTM E709	10% of all fillet welds and 100% of all full penetration welds on members thinner than 5/16".
Ultrasonic Testing ASTM E164	100% of all full penetration welds on members thicker than 5/16"
Radiographic Testing ASTM E94	When requested by Architect or as substitute for magnetic particles testing or ultrasonic testing.

b) Reduced Frequency of Ultrasonic Testing: Initially, all welds requiring 100% testing shall be tested at the rate of 100% in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5% of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25%. If the reject rate increases to 5% or more, 100% testing shall be re-established until the rate is reduced to less than 5%. The percentage of rejects shall be calculated for each welder independently. A sample of at least 40 completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over 3 feet in length, each 12 linear inch increment of welds, one inch or less in thickness, shall be considered one weld. For evaluating the reject rate of continuous welds greater than 1 inch thickness, each 6 linear inches shall be considered one weld.

c) Reduced Frequency of Magnetic Particle Testing: Initially, all welds requiring 100% testing shall be tested at the rate of 100% in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5% of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 10%. If the reject rate increases to 5% or more, 100% testing shall be re-established until the rate is reduced to less than 5%. The percentage of rejects shall be calculated for each welder independently. A sample of at least 20 completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. This reduction is not permitted on welds in the K-area, at repair sites, weld tab and backing removal sites and access holes.

g. Correction of Defective Welds: Weld areas containing defects exceeding the standards of acceptance in AWS D1.1 and AWS D1.8 shall be corrected in accordance with AWS D1.1, Section 3.7 and AWS D1.8. Additional testing of the repaired areas shall be required.

3. Welded Threaded Studs, Concrete Anchors, and Shear Connector Studs: Test and inspect installation in accordance with AWS D1.1. Random sample and test from stock furnished to each project. Tests shall meet the requirements of ASTM A108.

   a. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   b. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

4. Testing High Strength Bolts, Slip – Critical Bolts, Nuts and Washers: Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using High-strength."

   a. Materials: If the manufacturer's certification is not available, sample and test bolts, nuts and washers in accordance with ASTM F3125, shipping lot method.
   b. Installation:

      1) Inspect slip critical connections and connections subject to direct tension in accordance with RCSC Specification for Structural Joints Using High-Strength Bolts.
      2) Tests shall be performed by an approved testing laboratory specifically approved for that purpose.
      3) The inspector shall check the materials, equipment, details of construction and installation procedure.
      4) The inspector shall furnish the Architect with a report that the work has been completed in every material respect in compliance with the approved drawings and specifications.

5. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Erect steel in accordance with the AISC Specification Section M4 and AISC Code Section 7 Except as modified herein.

1. Where parts cannot be assembled or fitted properly as a result of errors in fabrication or of deformation due to handling or transportation, report such condition immediately to the Architect and obtain approval for the methods of correction before proceeding with making any corrections.
2. Do not heat heat-treated parts for straightening.
3. Drain steelwork properly; fill pockets in structures exposed to the weather with an approved waterproof material.
4. When calibrated wrenches are used for tightening bolts, calibrate them at least once each working day using not less than three typical bolts of each diameter.

C. All structural steel framing shall be erected by experienced riggers and shall be carefully planned and laid out so that minimum cutting will be required. The work shall be erected plumb, square, and true to a line and level and in precise position as indicated. Temporary bracing, shoring and guys shall be introduced wherever necessary to provide for loads and stresses to which the structure may be subjected. Temporary bracing shall be left in place as long as may be required for safeguarding all

parts of the work. As the erection progresses, the work shall be securely bolted up or welded, as required by the drawings to take care of all dead load, lateral forces and erection stresses.

D. Provide anchor bolts and other connections required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for setting bolts to accurate locations. Tighten anchor bolts after supporting members have been positioned and plumbed. Do not use impact torque wrenches to tighten anchor bolts set in concrete or masonry.

E. Base Bearing and Leveling Plates: Clean concrete bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required to maintain plates in proper position while being grouted. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
2. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure prior to imposing dead or live loading on columns. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of weld made, and methods in correcting welding work. Visible welded joints shall be considered "finished" welds and shall be carefully executed to preclude the necessity of grinding or otherwise finishing. However, when the appearance of the weld is unacceptable, in the opinion of the Architect, grinding shall be of the highest standard for both field and shop practice.

G. Temporary welds, run-off plates, and backing strips shall be removed where exposed in the final structure.

H. Remove erection bolts on exposed, welded construction, fill holes with plug welds and grind smooth.

I. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

J. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

K. Splice members only where indicated.

L. Do not use thermal cutting during erection.

M. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

N. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Contractor Responsibilities:

1. The Contractor shall maintain control of the quality of materials and workmanship in order to conform with the drawings and specifications.
2. To facilitate testing and inspection, the Contractor shall:

    a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
    b. Provide access to the Work for the designated Testing and Inspection Agency.
    c. Furnish all necessary materials and labor to assist the designated Testing and Inspection Agency in obtaining and handling samples at the project or other sources of materials.
    d. Provide and maintain for the sole use of the Testing and Inspection Agency adequate facilities for safe storage test specimens on the project site.

3. The Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Testing and Inspection Services:

1. Testing and inspections shall be performed by the designated Testing and Inspection Agency.
2. Testing and inspections shall be in accordance with the California Building Code, Section 1705A.2 and Table 1705A.2.1, DSA Testing and Inspections form DSA 103, and Structural Drawings Special Inspection Criteria.
3. Steel Testing: All steel used for structural purposes shall be identified as required by CBC Section 2202A.1. Manufacturer’s mill analyses and test reports are acceptable for properly identified steel, but the enforcement agency may require

additional testing to determine the quality of the steel if there is any doubt as to its acceptability. Any steel not properly identified shall be tested to meet the minimum chemical and mechanical requirements of the ASTM standard appropriate for the steel specified for the structure.

a. Fabrication shall not commence until steel members designated on the Structural Testing and Inspection Schedule have been tested. Tests shall be made by an independent testing laboratory approved by the Architect. Reports certifying that the materials and workmanship conform to the contract documents shall be submitted to the Architect and the Division of the State Architect.

4. Inspection of Field Erection:

   a. Verify qualifications of field procedures and personnel.
   b. Inspect erection of structural steel work for conformance with the drawings and specifications.

5. Inspection of Welding: Field welding operations including the installation of automatic end-welded stud shear connectors shall be inspected by a certified Welding Inspector meeting the requirements of AWS QC1. The Contractor shall schedule their operations to provide a minimum of 24 hours notice to the welding inspector so that all welding operations may be inspected.

   a. The Welding Inspector shall make a systematic record of all welds; recording shall include the following:

      1) Names and identification marks of welders.
      2) List of defective welds.
      3) Manner of correction of defects.

   b. The Welding Inspector shall check the material, equipment, procedure, welds, and the ability of each welder.
   c. Acceptance criteria shall be based on statically loaded connections. Upon detection of a rejectable weld, the inspector shall notify the Contractor, and observe removal of defects and repairs.
   d. The welding inspector shall tag or stamp accepted weldments with the inspector's identification stamp.
   e. A report stating that the welding required to be inspected is proper and has been done in conformity with approved drawings and specifications shall be furnished to the Architect.
   f. Welding inspections, testing, and frequency shall conform to AWS D1.1, AWS D1.8, and related AISC documents. The Welding Inspector shall use all means necessary to determine the quality of the welds. However, the following tests and inspections shall be performed as a minimum:

      1) Visual Inspection of Welding:

         a) Observe multi-pass and full penetration welds continuously (i.e. the welding inspector shall be present at all times).

b) Observe single pass fillet welds periodically. The inspector shall check the qualifications of the welders at the start of the work and then make final inspection of all welds for compliance prior to completion of welding.
c) After the welding is completed, Contractor shall hand or power nylon brush welds, and thoroughly clean them before inspection.
d) Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size; and insufficient throat and concavity.
e) Inspect the preparation of groove welds for adequate throat opening and for snug positioning of back-up bars.
f) Check the type and size of electrodes to be used for the various joints and positions. Check the storage facilities to see if they are adequate to keep the electrodes dry.
g) Verify the use of proper pre-heat and interpass temperatures.
h) Observe the technique of each welder periodically with the use of a welding inspection shield.

2) Nondestructive Testing of Welding:

a) Welds shall be non-destructive tested by one of the following methods in accordance with AWS D1.1 and AWS D1.8 at the frequency noted below:

Test Method	Frequency
Liquid Dye Penetrant Testing	When requested by Architect.
Magnetic Particle Testing	10% of all fillet welds and 100% of all full penetration welds on members thinner than 5/16".
Ultrasonic Testing	100% of all full penetration welds on members thicker than 5/16"
Radiographic Testing	When requested by Architect or as substitute for magnetic particles testing or ultrasonic testing.

b) Reduced Frequency of Ultrasonic Testing: Initially, all welds requiring 100% testing shall be tested at the rate of 100% in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5% of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25%. If the reject rate increases to

5% or more, 100% testing shall be re-established until the rate is reduced to less than 5%. The percentage of rejects shall be calculated for each welder independently. A sample of at least 40 completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over 3 feet in length, each 12 linear inch increment of welds, one inch or less in thickness, shall be considered one weld. For evaluating the reject rate of continuous welds greater than 1 inch thickness, each 6 linear inches shall be considered one weld.

c) Reduced Frequency of Magnetic Particle Testing: Initially, all welds requiring 100% testing shall be tested at the rate of 100% in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5% of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 10%. If the reject rate increases to 5% or more, 100% testing shall be re-established until the rate is reduced to less than 5%. The percentage of rejects shall be calculated for each welder independently. A sample of at least 20 completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. This reduction is not permitted on welds in the K-area, at repair sites, weld tab and backing removal sites and access holes.

g. Correction of Defective Welds: Weld areas containing defects exceeding the standards of acceptance in AWS D1.1 and AWS D1.8 shall be corrected in accordance with AWS D1.1, Section 3.7 and AWS D1.8. Additional testing of the repaired areas shall be required.

6. Welded Threaded Studs, Concrete Anchors, and Shear Connector Studs: Test installation in accordance with AWS D1.1. Random sample and test from stock furnished to each project. Tests shall meet the requirements of ASTM A108.

   a. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   b. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

7. Testing High Strength Bolts, Slip – Critical Bolts, Nuts and Washers:

   a. Materials: If the manufacturer's certification is not available, sample and test bolts, nuts and washers in accordance with F3125, shipping lot method.

b. Installation:

1) Inspect slip critical connections and connections subject to direct tension in accordance with RCSC Specification for Structural Joints Using High-Strength Bolts..
2) Tests shall be performed by an approved testing laboratory specifically approved for that purpose.
3) The inspector shall check the materials, equipment, details of construction and installation procedure.
4) The inspector shall furnish the Architect with a report that the work has been completed in every material respect in compliance with the approved drawings and specifications.

8. Additional testing and inspecting will be performed to determine compliance of replaced or additional work with specified requirements.

a. The cost of additional testing and inspection of replaced work will be paid for by the Owner with the amount being deducted from the Contract Amount by a Change Order.

3.5 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

SECTION 051213

ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Architecturally exposed structural steel (AESS).
2. Division 05 Section "Structural Steel Framing" requirements that also apply to AESS.

B. Related Requirements:

1. Division 05 Section “Structural Steel Framing” for requirements for structural steel framing.
2. Division 05 Section "Metal Fabrications" for steel items not defined as structural steel.
3. Division 09 Section “Painting” for surface preparation and priming requirements.

1.3 DEFINITIONS AND APPLICABILITY

A. AESS: Architecturally exposed structural steel. Apply categories as indicated below:

B. Category AESS 1: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 1 and may be designated AESS 1 or Category AESS 1 in the Contract Documents.

1. Applicable to all exposed to view structural steel framing not covered under AESS Categories 3 & 4, except at janitor, mechanical, electrical, communication and elevator machine rooms.

C. Category AESS 2: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 2 and is designated as AESS 2 or Category AESS 2 in the Contract Documents.

1. Applicable to AESS Categories 3 and 4.

D. Category AESS 3: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 3 and is designated as AESS 3 or Category AESS 3 in the Contract Documents.

1. Applicable to all interior exposed to view structural steel columns, beams and related miscellaneous steel including guards, balcony railing, curtain wall related steel support framing and steel entry door supports at first and second floor public, student and staff areas and rooms.
2. Applicable to exterior exposed to view steel columns, beams and support framing for vertical metal fins and similar elements.
3. Exposed to view steel at janitor, mechanical, electrical, communication and elevator machine rooms do not require compliance with this category.

E. Category AESS 4: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 4 and is designated as AESS 4 or Category AESS 4 in the Contract Documents.

1. Applicable to all exposed to view structural steel columns, beams, stringers and miscellaneous related connection/anchorage elements at stairs.

F. SEAC/RMSCA Guide Specification: SEAC/RMSCA's "Sample Specification, Section 05 02 13: Architecturally Exposed Structural Steel."

1.4 COORDINATION

A. Coordinate surface preparation requirements for shop-primed items.

B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data:

1. Filler.
2. Primer.
3. Galvanized-steel primer.
4. Etching cleaner.
5. Galvanized repair paint.

B. Shop Drawings: Show fabrication of AESS components, Shop Drawings for structural steel may be used for AESS.

1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
3. Include embedment Drawings.
4. Indicate orientation of mill marks and HSS seams.
5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
7. Indicate exposed surfaces and edges and surface preparation being used.
8. Indicate special tolerances and erection requirements.
9. Indicate weep holes for HSS and vent holes for galvanized HSS.
10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.

C. Samples: Submit Samples to set quality standards for AESS.

1. Two steel plates, 3/8 by 8 by 4 inches, with long edges joined by a groove weld and with weld ground smooth.
2. Steel plate, 3/8 by 8 by 8 inches, with one end of a short length of rectangular steel tube, 4 by 6 by 3/8 inches, welded to plate with a continuous fillet weld and with weld ground smooth and blended.

1.7 INFORMATIONAL SUBMITTALS

A. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.

1. Build mockup of typical portion of AESS as shown on Drawings or as directed by Architect.
2. Coordinate painting requirements with Division 09 Section “Painting.”
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.

1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.10 FIELD CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

2.2 FILLER

A. Polyester filler intended for use in repairing dents in automobile bodies.

2.3 PRIMER

A. Steel Primer: Comply with requirements of Division 09 Section “Painting.”

B. Galvanized-Steel Primer:

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 ASTM A780/A780M.

2.4 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.

B. Category AESS 1:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch closure plates.
6. Limit butt and plug weld projections to 1/16 inch.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.

C. Category AESS 2: Comply with requirements of Category AESS 1 plus the following:

1. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
2. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
3. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
4. Conceal fabrication and erection markings from view in the completed structure.
5. Make welds uniform and smooth.

D. Category AESS 3: Comply with requirements of Categories AESS 1 and AESS 2 in addition to the following:

1. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
2. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
3. Orient HSS seams as indicated or away from view.
4. Align and match abutting member cross sections.
5. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of 1/8 inch. At closed joints, maintain uniform contact within 1/16 inch.
6. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.

E. Category AESS 4: Comply with requirements of Categories AESS 1, AESS 2, and AESS 3 plus the following:

1. Treat HSS seams to appear seamless.
2. Contour and blend welds and weld transitions between members, removing splatter exposed to view.

3. Fill surface imperfections with filler and sand smooth to achieve surface quality approved by Architect.
4. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.

F. Erection marks, painted marks, and other marks are permitted on galvanized steel surfaces of completed structure.

2.5 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Corrosion-resisting (weathering) steel surfaces.
5. Galvanized surfaces unless indicated to be painted.

B. Surface Preparation: Clean nongalvanized surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 6 (WAB)/NACE WAB-3.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and eased edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.

1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
2. Grind tack welds smooth.
3. Remove backing and runoff tabs, and grind welds smooth.
4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
5. Remove erection bolts in Category AESS 4 AESS, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
6. Fill weld access holes in Category AESS 4 AESS with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
7. Conceal fabrication and erection markings from view in the completed structure.

B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.

1. Erection of Category AESS 1 and Category AESS 2:

    a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
    b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
    c. Remove weld spatter, slivers, and similar surface discontinuities.
    d. Grind off butt and plug weld projections larger than 1/16 inch.
    e. Continuous welds shall be of uniform size and profile.
    f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
    g. Splice members only where indicated on Drawings.
    h. No torch cutting or field fabrication is permitted.

2. Erection of Category AESS 3: Comply with additional erection requirements noted above for Categories AESS 1 and AESS 2 in addition to the following:

    a. Weld profiles, quality, and finish shall be as approved by Architect.
    b. Make joint welds, including tack welds, appear continuous by filling intermittent welds.

3. Erection of Category AESS 4: Comply with additional erection requirements noted above for Categories AESS 1, AESS 2 and AESS 3 in addition to the following:

    a. Grind welds smooth.
    b. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
    c. Oversize welds where ground, contoured, or blended, and grind to provide a smooth transition, matching profile approved by Architect.

3.4 FIELD CONNECTIONS

A. Welded Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

3.5 REPAIR

A. Touchup Priming: Cleaning and touchup priming are specified in Division 09 Section “Painting.”

3.6 FIELD QUALITY CONTROL

A. Testing: Testing of structural steel framing shall be in accordance with Division 05 Section “Structural Steel Framing.” The testing agency is not responsible for enforcing requirements relating to aesthetic effect.

B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

END OF SECTION

SECTION 053100

STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof deck.
2. Acoustical roof deck including sound absorbing insulation strips.
3. Composite floor deck.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for concrete fill over steel floor deck.
2. Division 05 Section "Structural Steel Framing" for structural steel framing and shop and field-welded shear connectors.
3. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 REFERENCED CODES AND STANDARDS

A. Comply with applicable provisions of the following codes and standards as adopted by the governing agency having jurisdiction over the project.

1. California Code of Regulations, Title 24, Part 2, California Building Code, 2022 Edition.
2. American Iron and Steel Institute (ANSI/AISI): “North American Specification for the Design of Cold-Formed Steel Structural Members.”
3. American Society for Testing and Materials (ASTM) Publications:

a. A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
b. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.

c. C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

4. American Welding Society (AWS) Publications:

a. D1.1 Structural Welding Code, Steel.
b. D1.3 Structural Welding Code, Sheet Steel.

5. Steel Deck Institute (SDI) Publication:

a. SDI-RD Standard for Steel Roof Deck.
b. SDI-C Standard for Composite Steel Floor Deck – Slabs.
c. SDI-QA/QC Standard for Quality Control and Quality Assurance for Installation of Steel Deck.

1.4 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Welding certificates for welding personnel.

D. Research/Evaluation Reports: For the following from ICC-ES or IAPMO:

1. Steel deck.
2. Power-actuated mechanical fasteners.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm using adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.7 COORDINATION

A. Coordinate installation of sound-absorbing insulation strips in topside of ribs of acoustical deck with roof insulation installation specified in Division 07 Sections as applicable to roof insulation to ensure protection of insulation strips against damage from effects of weather and other causes.

B. Coordinate installation of composite steel floor deck with welded shear studs specified in Division 05 Section “Structural Steel Framing.”

C. Coordinate placement of concrete with Division 03 Section “Cast-in-Place Concrete.” Concrete must be placed with care avoiding impacts by dropping or dumping. Runways must be planked if using buggies. Heavy concentrated loads of concrete or crews and uniform loads exceeding 20 psf must be investigated for shoring consideration.

D. Coordinate concrete mixture with Division 03 Section “Cast-in-Place Concrete.” Concrete admixtures containing chloride salts shall not be used with galvanized deck.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIRMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's publication "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with fire-resistance design designations indicated on Drawings and with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Vertical Design Criteria:

1. Loads as indicated on Drawings.
2. Construction loads shall be assumed to apply to the non-composite deck.
3. Maximum deflection of composite floor deck:

    a. Typical:

        1) Under Live Load: Clear span (inches)/360.
        2) Under Total Load: Clear span (inches)/240.

    b. Second Floor Upper Framing

        1) Under Live Load: Clear span (inches)/480.
        2) Under Total Load: Clear span (inches)/360.

2.2 ROOF DECK

A. Basis of Design: Design, Drawings, and Specifications are based on manufacturer and product(s) indicated on the Structural Drawings.

1. Provide product(s) indicated or submit a request for substitution per Division 01 “Section Substitution Procedures.”

a. Products not included in the approved Drawings and Specifications will require a DSA Construction Change Document to be reviewed and approved by DSA, refer to Division 01 Section “Contract Modification Procedures.” Expenses for Architectural and Engineering services, including DSA services, as a result of processing construction change documents will be deducted from the contract amount by a change order.

B. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with referenced standards and with the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40 min., with G60 zinc coating min. See Drawings for locations and type.
2. Deck Profile: As indicated on Drawings.
3. Profile Depth: As indicated on Drawings.
4. Design Uncoated-Steel Thickness: As indicated on Drawings.
5. Side Laps: Form side laps with interlocking edges to permit seam welding, button punch connection, and/or screw fasteners.
6. Span Condition: Double span or as indicated on Drawings.

2.3 COMPOSITE FLOOR DECK

A. Basis of Design: Design, Drawings, and Specifications are based on manufacturer and product(s) indicated on the Structural Drawings.

1. Provide product(s) indicated or submit a request for substitution per Division 01 “Section Substitution Procedures.”

a. Products not included in the approved Drawings and Specifications will require a DSA Construction Change Document to be reviewed and approved by DSA, refer to Division 01 Section “Contract Modification Procedures.” Expenses for Architectural and Engineering services, including DSA services, as a result of processing construction change documents will be deducted from the contract amount by a change order.

B. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with references standards, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, with G60 zinc coating.
2. Profile Depth: As indicated on Drawings.
3. Design Uncoated-Steel Thickness: As indicated on Drawings.

4. Span Condition: Triple span or as indicated on Drawings.

2.4 ACOUSTICAL ROOF DECK

A. Basis of Design: Design, Drawings, and Specifications are based on manufacturer and product(s) indicated on the Structural Drawings.

1. Provide product(s) indicated or submit a request for substitution per Division 01 “Section Substitution Procedures.”

a. Products not included in the approved Drawings and Specifications will require a DSA Construction Change Document to be reviewed and approved by DSA, refer to Division 01 Section “Contract Modification Procedures.” Expenses for Architectural and Engineering services, including DSA services, as a result of processing construction change documents will be deducted from the contract amount by a change order.

B. Acoustical Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with referenced standards and with the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 40, with G60 zinc coating.
2. Deck Profile: As indicated on Drawings.
3. Profile Depth: As indicated on Drawings.
4. Design Uncoated-Steel Thickness: As indicated on Drawings.
5. Span Condition: Double span or as indicated on Drawings.
6. Acoustical Perforations: Cellular deck units with manufacturer's standard perforated flat-bottom plate welded to ribbed deck.
7. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber.

2.5 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch (20 gage) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, with factory-punched hole of 3/8-inch minimum diameter.

I. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick (14 gage), of same material and finish as deck. For drains, cut holes in the field.

J. Welding Electrodes: E60XX.

K. Galvanizing Repair Paint: ASTM A 780.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install and fasten deck panels and accessories in accordance with the Contract Documents, manufacturer's written instructions, requirements of SDI-RD or SDI-C as applicable, and requirements in this Section.

1. Do not use unanchored deck units as a work or storage platform.
2. Permanently anchor all units placed by the end of each working day.
3. Keep material dry before, during and after installation.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting framing and adjust to final position with ends accurately aligned and with not less than 2 inches of bearing on supporting framing before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Place units end to end before permanently fastening.
2. Align ribs over the entire length of run.

3. Place deck panels flat and square and fasten to supporting framing without warp or deflection.

E. Openings: Reinforce and frame openings through floor as necessary for rigidity and load-carrying capacity. Holes or other openings required for the work of other trades shall be drilled or cut and adequately reinforced by the respective trade; such holes or other openings larger than 6 inches in diameter shall be reviewed by the Architect.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Automatic Welded Shear Connector Studs: Coordinate installation of welded shear studs with Division 05 Section “Structural Steel Framing.”

I. Perform all welding in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturers of the base metal alloys being used. Location, size and spacing of welds shall be designed to withstand the loads specified herein and in accordance with the Steel Deck Institute recommendations and as shown on the shop drawings.

1. Clean welds immediately by chipping and wire brushing.
2. Heavily coat welds, cut edges, and damaged portions of galvanized finishes with galvanized repair paint.

J. Hammering which will injure or distort panels or framing will not be permitted or acceptable.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members as indicated on Drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated on Drawings.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing and end joints as indicated on Drawings.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck at spacings of not more than 12 inches apart with at least one weld or fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports as indicated on Drawings.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written

instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

G. Sound-Absorbing Insulation: Install formed insulation into topside of ribs of deck in coordination with roof insulation installation.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members as indicated on drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated on Drawings.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing and end joint condition as indicated on Drawings.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing agency will report inspection results promptly and in writing to the Division of the State Architect, Architect and Contractor.
2. Additional inspecting will be performed to determine compliance of corrected work with specified requirements. Expense for additional inspecting will be deducted from the Contract amount.

B. Contractor Duties and Responsibilities: It shall be the responsibility of the Contractor to maintain control of the quality of materials and workmanship and to obtain conformance with the drawings and specifications. To facilitate testing and inspection, the contractor shall:

1. Furnish all necessary materials and labor to assist the designated testing agency in obtaining and handling samples at the project or other sources of materials.

2. Advise the designated testing agency sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.
3. The Contractor shall correct deficiencies in the work which inspections and laboratory test reports indicate the Work to not be in compliance with requirements.

C. Testing and Inspection Services: The following testing and inspection services shall be performed by the designated laboratory and additional testing as may be necessary to reconfirm any non-compliance of original work to show compliance of corrected work.

1. Steel Testing: Mill analysis and test reports certified by the manufacturer may constitute sufficient evidence of conformity with the specifications provided the material can be identified in the fabricating shop in accordance with ASTM A6 by a representative of an independent testing laboratory approved by the Architect.

    a. When material cannot be identified or its source is questionable, one set of tension, elongation and bend tests shall be made for each 5 tons or fractional part thereof of each size. Provide product analysis to verify chemical composition.

2. Inspection of painting: Visual inspection touch-up painting.

3. Inspection of Welding: All field welding operations including the installation of automatic end-welded stud shear connectors shall be inspected by a certified Welding Inspector meeting the requirements of AWS QC1 and who has been approved by the Architect. The Contractor shall schedule his operations to provide a minimum of 24 hours notice to the welding inspector so that all welding operations may be inspected.

    a. The Welding Inspector shall make a systematic record of all welds. This record shall include:

        1) Names and identification marks of welders.
        2) List of defective welds.
        3) Manner of correction of defects.

    b. The Welding Inspector shall check the material, equipment and procedure as well as the welds. He shall also check the ability of the welder.
    c. Upon detection of a rejectable weld, the inspector shall notify the Contractor, and observe removal of defects and repairs.
    d. The Welding Inspector shall use all means necessary to determine the quality of the welds. Inspection procedures shall conform to ASTM D1.3. The following visual inspection of welding shall be performed as a minimum:

        1) Observe single pass fillet welds and arc spot welds periodically. The inspector shall check the qualifications of the welders at the start of the work and then make final inspection of all welds for compliance prior to completion of welding.
        2) After the welding is completed, hand or power nylon brush welds, and thoroughly clean them before inspection.
        3) Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled

craters; gas pockets; undercuts; overlaps; size; and insufficient throat and concavity.

4) Check the type and size of electrodes to be used for the various joints and positions. Check the storage facilities to see if they are adequate to keep the electrodes dry.

5) Observe the technique of each welder periodically with the use of a welding inspection shield.

e. Welded Threaded Studs: Test installation in accordance with AWS D1.1. Random sample and test from stock furnished to each project. Tests shall meet the requirements of ASTM A108.

3.6 REPAIRS AND PROTECTION

A. Damaged materials which cannot be easily corrected without visible defects or weakening of members shall be discarded and replaced.

B. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

1. Galvanizing repair does not apply to puddle welds and headed studs at composite metal deck locations.

C. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 054000
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Load-bearing wall framing.
2. Exterior wall and soffit framing.
3. Interior non-load-bearing steel framing systems for interior walls, ceilings, and soffits.
4. Ceiling joist framing.
5. Soffit framing.

B. Related Sections include the following:

1. Division 03 Section “Post Installed Concrete and Masonry Anchors” for post installed anchors in concrete and/or masonry.
2. Division 05 Section "Structural Steel Framing" for structural steel framing supporting cold formed metal framing.
3. Division 05 Section "Metal Fabrications" for miscellaneous framing with steel angles, channels, plates, and shapes.
4. Division 09 Section “Gypsum Board” for gypsum board attached to steel framing systems.
5. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for non-load-bearing metal shaft-wall framing, gypsum panels, and other components of shaft-wall assemblies.

1.3 STANDARDS AND REFERENCES

A. California Code of Regulations, Title 24, Part 2, California Building Code, 2022 Edition.

B. American Iron and Steel Institute (AISI) Specifications and Standards:

1. AISI S100 "North American Specification for the Design of Cold-Formed Steel Structural Members".
2. AISI S202 Code of Standard practice for Cold-Formed steel framing.
3. AISI S220 North American Standard for Cold-Formed steel non-structural framing.
4. AISI S240 North American Standard for Cold-Formed steel structural framing.

5. AISI S400 North American Standard for Seismic Design of Cold-Formed steel structural systems.

C. ASTM International (ASTM):

1. ASTM A 653, Steel Sheet, Zinc Coated (galvanized) or zinc-iron alloy-coated by the Hot Dip Process, Physical (Structural) Quality.
2. A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
3. C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases.
4. A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
5. ASTM A 1008, Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength, Low Alloy with improved formability.
6. ASTM A 1011, Sheet & Strip, Hot-Rolled, Carbon, Structural, High Strength, Low Alloy with improved formability.
7. ASTM C 645, Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
8. ASTM C 754, Installation of Steel Framing Members to Receive Screw Attached Gypsum Board.
9. ASTM C 1007, Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
10. C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

D. Federal Specifications:

1. FF-P-395, Pin, Drive, Guided and Pin Drive, Power Actuated (Fasteners for Power Actuated and Hand Actuated Fastening Tools.
2. FF-S-325, Shield, Expansion: Nail, Expansion: and Nail, Drive Screw (Devices, Anchoring Masonry).

E. American Welding Society (AWS) Publication:

1. D1.1, Structural Welding Code, Steel.
2. D1.3, Structural Welding Code, Sheet Steel.

F. Metal Lath/Steel Framing Association (ML/SFA) Publication:

1. ML/SFA 540, Lightweight Steel Framing Systems.
2. ML/SFA 541, Selection Guidelines: Lightweight Steel Framing.
3. ML/SFA 920, Guide Specifications for Metal Lathing and Furring.

G. Steel Stud Manufacturers Association (SSMA):

1. Product Technical Information, ICC ESR-3064P.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer's written installation procedures and details.

1. Provide documentation that stud and track members are certified in accordance with the product certification program of the Steel Framing Industry Association (SFIA) or a similar organization that provides a verifiable code compliance program.

B. Evaluation Reports: From ICC-ES or IAPMO ES, or certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 accreditation criteria, for the following:

1. Metal framing.
2. Post installed concrete anchors.
3. Powder-actuated fasteners.
4. For sill sealer gasket showing compliance with ICC-ES AC380.

C. Welding certificates (If products will be welded).

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Use adequate number of skilled workmen who are thoroughly trained and experienced in the erection of cold formed steel framing and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling. Cover stored metal framing with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, comply with AISI standards listed in Part 1 Standards and References.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. California Expanded Metal Products Company (CEMCO).
2. ClarkDietrich.
3. MarinoWare; a Division of Ware Industries.
4. SCAFCO Corp.

B. Source Limitations: Obtain metal framing systems for a single source from a single manufacturer.

2.3 EXTERIOR COLD FORMED METAL FRAMING MEMBERS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Identification of Metal Framing Members: Load bearing cold formed steel framing members shall be identified as required by 2022 CBC Section 2202A for projects governed by the Division of the State Architect.

C. Framing Members General: Comply with AISI Standards and ASTM C 955, Section 8 for conditions indicated.

D. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, or ASTM A653/A653M, metallic coated, of grade and coating weight as follows:

1. Grade:

a. ST33H, 33 KSI for members 18 gauge (0.043 inch) and lighter in thickness.
b. ST50H, 50 KSI for members 16 gauge (0.054 inch) and heavier in thickness.

2. Coating: G60 or equivalent.

E. Steel Sheet for Vertical Deflection and/or Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 50, Class 1 or 2.
2. Coating: G90.

F. Framing Members, General: Comply with ASTM C 955 for conditions indicated.

G. Steel Studs and Joists: Manufacturer's standard C-shaped steel studs and joists of web depths indicated, stiffened flanges, and as follows:

1. Studs: Punched openings regularly spaced along webs.
2. Joists: Un-punched webs.
3. Minimum Base-Metal Thickness: As indicated on Drawings.
4. Flange Width: As indicated on Drawings, 1-5/8 inches minimum.
5. Section Properties: As indicated on Drawings.

H. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches unless otherwise indicated.

I. Steel Headers: Manufacturer's standard C-shapes or L-shapes, matching studs, used to form header beams, of web depths indicated, punched, with stiffened flanges, and as indicated on the Drawings.

J. Deflection Track: Single or double deflection track as indicated on Drawings.

1. For sloped conditions:

a. Provide pitched track(s) at walls perpendicular to slope.
b. Provide rake track at walls parallel to slope.

2. Single Deflection Track: Manufacturer's deflection track as indicated on Drawings; single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, minimum base metal thickness matching studs.
3. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges, minimum base metal thickness matching studs. Outer track to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure

K. Vertical Deflection Clips: Manufacturer's standard bypass or head clips as indicated on Drawings, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

L. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

M. Exterior wall cladding support framing: At exterior walls with 2” rigid insulation board as a substrate for wall cladding systems, provide galvanized steel Z-girts and J-moldings from 0.0312 inch thick (20 gauge) minimum steel. Z-girts shall be 2 x 2 x 2 inch size and J-moldings shall be 3 ½ x 2 x 2 inch size J-shaped frame members.

2.4 INTERIOR NON-LOAD-BEARING STEEL FRAMING MEMBERS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Framing Members General: Comply with AISI Standards and ASTM C 645, Section 10 and Steel Stud Manufacturers Association (SSMA), Product Technical Information, ESR-4064P, or the Steel Framing Industry Association (SFIA) Technical Guide for conditions indicated.

1. Steel Sheet Components: Comply with AISI Standards requirements for metal, unless otherwise indicated.
2. Protective Coating: Comply with AISI Standards, ASTM A653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.

C. Steel Studs, Joists, and Track: AISI Standards and ASTM C 645, Section 10, of minimum base metal thickness and size as indicated on the Drawings.

1. Joists shall be un-punched.

D. Slip-Type Head Joints: Slip type head joints shall be as indicated on Drawings, where not indicated on Drawings, provide one of the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-inch minimum vertical movement.

2. Single Long-Leg Track System: ASTM C645 top track with 2 1/2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.

3. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
4. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. For sloped conditions:

1) Provide pitched track(s) at walls perpendicular to slope.
2) Provide rake track at walls parallel to slope.

b. Subject to compliance with requirements, provide one of the following:

1) Dietrich Metal Framing; SLP-TRK.
2) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
3) Superior Metal Trim; Superior Flex Track System (SFT).

4) Scafco: Slotted Track.

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs. Subject to compliance with requirements, provide one of the following:

1. Dietrich Metal Framing; SLP-TRK.
2. Fire Trak Corp.; Fire Trak
3. Metal-Lite, Inc.; The System.

F. Backing Plate: Steel sheet for blocking and bracing in size and thickness indicated on Drawings, 0.0312-inch thick (20 gauge) minimum.

G. Flat Strapping: 1-1/2 inch wide by 0.0296-inch thick (20 gauge) flat steel strapping unless otherwise indicated on Drawings.

H. Cold-Rolled Channels for Bridging and Furring: Steel, 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.

1. Depth: 3/4-inch or 1-1/2-inch as required for project conditions, otherwise indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.0538-inch thick, galvanized steel.

I. Hat-Shaped, Rigid Furring Channels: AISI Standards of size and metal thickness as indicated on the Drawings, 0.0312-inch thick (20 gauge) minimum thickness.

J. Resilient Furring Channels: 1/2-inch deep, asymmetrical shaped, steel sheet members designed to reduce sound transmission.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: Conform to ASTM A307.

C. Post Installed Concrete Anchors: Fabricated from corrosion-resistant materials; manufacturer, size, and type as indicated on Drawings, and as specified in Division 03 Section “Post Installed Concrete Anchors.”

D. Power-Actuated Fasteners: Fastener of manufacturer, size, and type as indicated on Drawings and as follows:

1. Concrete Attachment: Hilti X-U (ICC ESR-2269) pins unless otherwise indicated on Drawings; 0.157 inch diameter steel pins with steel washers; embedment of steel pins into concrete shall not be less than 1-1/4 inch.
2. Steel Attachment: Hilti X-U 15 (ICC ESR-2269) unless otherwise indicated on Drawings; 0.145 inch diameter steel pins with steel washers; protrusion of steel pins through steel members shall not be less than 1/4 inch.

E. Screw Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: E60XX electrodes complying with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Nonmetallic, Nonshrink Grout: Factory packaged, nonmetallic, noncorrosive, nonstaining grout complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and assemblies plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by not less than three exposed screw threads.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets at exterior walls to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION OF FRAMING, GENERAL

A. Install framing components in sizes and spacings indicated on Drawings and according to manufacturer's written instructions, but not less than those required by referenced installation standards for assembly types and other assembly components indicated. Comply with the following installation standards:

1. Exterior and Load Bearing Framing:

    a. Install exterior cold-formed metal framing according to AISI Standards.

2. Interior Non-Structural Framing:

    a. ASTM C754.
    b. ASTM C 840 as applicable to metal framing systems for gypsum board.
    c. ICC or IAPMO Engineering Report for metal framing system.

B. Install metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten metal framing members by welding or screw fastening. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Drawings and complying with requirements for spacing, edge distances, and screw penetration.

C. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

D. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. Install insulation, specified in applicable Division 07 Section, in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

G. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings indicated on Drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as indicated on Drawings, spacing shall not to exceed 24 inches on center.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings as indicated on Drawings with not less than two studs at each jamb. Fasten jamb members together to uniformly distribute loads. Extend jamb studs to the structure above, where jamb studs do not extend to the structure above, provide diagonal bracing perpendicular to the wall and located directly above jamb studs and fasten bracing to the structure above. Screw vertical studs at jambs to jamb anchor clips on door frames.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Isolate non-load-bearing steel wall framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install top of wall deflection tracks of type indicated on Drawings and anchor to building structure.
2. Connect vertical deflection clips to studs and anchor deflection clips to building structure as indicated on Drawings.
3. Connect drift clips to cold formed metal framing and anchor drift clips to building structure as indicated on Drawings.

J. Install horizontal bridging in stud system, spaced 48 inches on center maximum, fasten bridging to stud at each stud intersection. Install bridging as indicated on Drawings, or if not indicated, install one of the following:

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Bridging: Combination of flat, taut, steel sheet straps, 1-1/2 by 0.0329 inch, and stud-track solid blocking of matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Drawings.

B. Install joists bearing on supporting framing, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Drawings.

C. Space joists not more than 2 inches from abutting walls, and as indicated on Drawings.

D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Drawings.

F. Install bridging at intervals indicated on Drawings. Fasten bridging at each joist intersection as follows:

1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.6 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.
2. Testing and inspecting agency will report test results promptly and in writing to Architect, Division of the State Architect, and Contractor.

3. The cost of additional testing and inspecting of corrected, replaced and/or additional Work will be paid for by the Owner and the cost will be deducted from the contract sum by a change order.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Contractor Duties and Responsibilities:

1. Contractor shall maintain control of the quality of materials and workmanship to conform to the drawings and specifications.
2. Facilitate testing and inspection as follows:

    a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
    b. Provide access to the Work for the designated Testing and Inspection Agency.
    c. Furnish all necessary materials and labor to assist the designated testing and inspecting agency in obtaining and handling samples at the project or other sources of materials.

3. Contractor shall correct deficiencies in the Work where tests and inspections indicate the Work does not comply with the Contract Documents.

D. Tests and Inspections:

1. The following testing and inspecting shall be performed by the designated Testing and Inspection agency.

    a. Welding of Load Resisting Framing: Inspecting and testing of structural welding of load resisting framing members shall be as required by 2022 CBC Section 1705A.2.5 for projects under the jurisdiction of DSA.

        1) Field and shop welds will be subject to testing and inspecting.

2. Steel Testing:

    a. Manufacturer’s mill analyses and test reports are acceptable for properly identified steel, but the enforcement agency may require additional testing to determine the quality of the steel if there is any doubt as to its acceptability. Any steel not properly identified shall be tested to meet the minimum chemical and mechanical requirements of the ASTM standard appropriate for the steel specified for the structure.
    b. Fabrication shall not commence until steel members designated on the Structural Testing and Inspection Schedule have been tested. Tests shall be made by an independent testing laboratory approved by the Architect. Reports certifying that the materials and workmanship conform to the contract documents shall be submitted to the Architect and the Division of the State Architect.

3. Shop Fabrication:

    a. Inspection of shop fabrication of all members shall be performed by an independent testing laboratory approved by the Architect.
    b. A report stating that all the materials and workmanship conform to approved drawings and specifications shall be submitted to the Architect.

4. Field Erection:

    a. Verify qualifications of field procedures and personnel.
    b. Inspect erection of cold formed steel work for conformance with the drawings and specifications.

5. Welding:

    a. All shop and field welding operations shall be inspected by a certified Welding Inspector meeting the requirements of AWS QC1 and who has been approved by the Architect. The Contractor shall schedule his operations to provide a minimum of 24 hours notice to the welding inspector so that all welding operations may be inspected.
    b. The Welding Inspector shall be an individual trained and thoroughly experienced in inspecting welding operations. The Welding Inspector's ability to distinguish between sound and unsound welding shall be reliably established.
    c. The Welding Inspector shall make a systematic record of all welds. This record shall include:

        1) Names and identification marks of welders.
        2) List of defective welds.
        3) Manner of correction of defects.

    d. The Welding Inspector shall check the material, equipment and procedure as well as the welds. He shall also check the ability of the welder.
    e. Upon detection of a rejectable weld, the inspector shall notify the Contractor, and observe removal of defects and repairs.
    f. The welding inspector shall tag or stamp accepted weldments with the inspector's identification stamp
    g. A report stating that the welding he is required to inspect, is proper and has been done in conformity with approved drawings and specifications shall be furnished to the Architect.
    h. The Welding Inspector shall use all means necessary to determine the quality of the welds. Inspection procedures shall conform to AWS D1.3. However, the following tests and inspections shall be performed as a minimum:

        1) Visual Inspection of Welding:

            a) Observe multi-pass and full penetration welds continuously (i.e. the welding inspector shall be present at all times).
            b) Observe single pass fillet welds periodically. The inspector shall check the qualifications of the welders at the start of the work

and then make final inspection of all welds for compliance prior to completion of welding.

c) After the welding is completed, hand or power nylon brush welds, and thoroughly clean them before inspection.

d) Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slag inclusions; excessive roughness; unfilled craters; gas pockets; undercuts; overlaps; size; and insufficient throat and concavity.

e) Inspect the preparation of groove welds for adequate throat opening and for snug positioning of back-up bars.

f) Check the type and size of electrodes to be used for the various joints and positions. Check the storage facilities to see if they are adequate to keep the electrodes dry.

g) Verify the use of proper pre-heat and interpass temperatures.

h) Observe the technique of each welder periodically with the use of a welding inspection shield.

2) Nondestructive Testing of Welding:

a) Welds shall be non-destructive tested by one of the following methods in accordance with AWS D1.1 at the frequency noted below:

Test Method	Frequency
Liquid Dye Penetrant Testing	When requested by Architect.
Magnetic Particle Testing	10% of all fillet welds and 100% of all full penetration welds
Radiographic Testing	When requested by Architect or as substitute for magnetic particles testing or ultrasonic testing.

b) Reduced Frequency of Testing: Initially, all welds requiring 100% testing shall be tested at the rate of 100% in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5% of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25%. If the reject rate increases to 5% or more, 100% testing shall be re-established until the rate is reduced to less than 5%. The percentage of rejects shall be calculated for each welder independently. A sample of at least 40 completed welds shall be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejectable defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over 3 feet in length, each 12 linear inch increment of welds, one inch or less in thickness, shall be considered one weld. For evaluating the reject rate of

continuous welds greater than 2 inch thickness, each 6 linear inches shall be considered one weld.

E. Remove and replace work where test results indicate that it does not comply with specified requirements.

F. Additional testing and inspecting will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer ensuring cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for applications where framing and supports are not specified in other Sections and for miscellaneous structural steel items and welds in construction with related AESS category steel framing.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel weld plates and angles for casting into concrete not specified in other Sections.
5. Pipe bollards where indicate in drawings.
6. Steel guards and hand railings.
7. Elevator pit ladders.
8. Elevator sump covers with perimeter edge angle.

B. Related Sections:

1. Division 03 Section “Post Installed Concrete And Masonry Anchors” for post installed anchors in concrete and/or masonry.
2. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
3. Division 05 Section "Structural Steel Framing."
4. Division 05 Section "Metal Stairs” for metal stairs.
5. Division 05 Section "Decorative Stainless Steel Railings” for stainless steel railings and brackets as indicated on drawings.
6. Division 05 Section “Metal Ladders” for ladders as indicated on drawings.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.

B. Shop Drawings: For metal fabrications, include plans, elevations, sections, and details of metal fabrications and their connections; show anchorage and accessory items. Show fabrication and installation details for metal fabrications.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research Reports: For post-installed anchors.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of in-place construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.6 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support metal fabrications temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg. F ambient; 180 deg F, material surfaces.

2.2 METAL PRODUCTS

A. Identification of Structural Steel: The fabricator shall maintain the identity of steel used for structural purposes and shall maintain suitable procedures and records attesting that the specified grade has been furnished, in compliance with AISC 360 and 2022 CBC Section 2202A.1.

1. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.

a. Mill markings may be covered by shop priming provided the fabricator provides identification mark over the primer that can be traced through documentation.

B. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

1. Provide galvanized finish for exterior installations where indicated.

F. Slotted Steel Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Basis of Design: Unistrut Corporation; P1000 Channel Framing System.
2. Size of Channels: 1-5/8 by 1-5/8 inches.
3. Channel Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; 0.108-inch (12 gage) nominal thickness.
4. Material for Fittings: Steel conforming to ASTM A 575, A 576, A 36, or A635; with finish matching channels.

G. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, structural steel, Grade 33, unless another grade is required by drawings.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

D. Anchor Bolts and Unheaded Rods: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Post Installed Concrete Anchors: Fabricated from corrosion-resistant materials; manufacturer, size, and type as indicated on Drawings and specified in Division 03 Section “Post Installed Concrete Anchors.”

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 Section “Painting.”

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of minimum 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Maintain identification markings of steel used for structural purposes until steel has been erected. Mill markings may be covered by shop priming provided the fabricator provides identification mark over the primer that can be traced through documentation.

B. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. Weld connections, corners, and seams continuously, unless otherwise indicated, to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
5. Cope ends of pipe or round tubing at connections to provide close fit.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate seams and connections that will be exposed to weather in a manner that excludes water. Provide weep holes for drainage where water may accumulate.

I. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

J. Provide for anchorage of type indicated on Drawings; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as indicated on the Drawings and as needed to complete the Work.

B. Fabricate miscellaneous framing and supports from steel shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by miscellaneous framing and supports.

1. Drill, cut, and tap miscellaneous framing and supports to field bolted connections and to receive hardware, hangers, and similar items.

C. Prime miscellaneous framing and supports used at interior applications.

D. Galvanize miscellaneous framing and supports used for exterior applications or where indicated.

2.7 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

2.9 METAL BOLLARDS

A. Fixed Bollards: Fabricate fixed metal bollards from Schedule 40 galvanized steel pipe.

1. Size: As indicated on Drawings, not less than 4 inches nominal diameter (4.5 inches actual outside diameter.

B. Removable Bollards: Fabricate removable metal bollards as indicated on Drawings from Schedule 80 steel pipe.

1. Size: As indicated on Drawings, not less than 4 inches nominal diameter (4.5 inches actual outside diameter).
2. Cap bollards with 1/4-inch thick steel plate.
3. Lift Handles: Provide removable bollards with two 1/2 inch diameter lift handles, 6 inches long and projecting 2 inches from bollard, located on opposite sides of the upper 12 inches of the bollard.
4. Collar: Provide minimum 3/8” thick collar welded to bollard at base of bollard located at grade level (Collar to bear on top of sleeve).
5. Sleeves: Fabricate sleeves for bollards from steel pipe or tubing having minimum 1/4-inch thick wall thickness, weld 1/4 inch thick steel plate to bottom of sleeve. Sleeve inside diameter shall provide 1/4 inch space around bollard (1/2 inch larger than bollard outside diameter). Depth of sleeve shall be not less than 24 inches deep or as indicated on the drawings, depth shall be 6 inches greater than embedment of bollard.
6. Provide provisions for locking bollard to sleeve with padlock (Padlock by Owner).
7. Galvanize bollard and sleeve after fabrication.

2.10 RAILINGS AND GUARDS

A. General: Fabricate railings and guards to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

B. Regulatory Requirements: Handrails, guards, and infill rails or panels shall comply with the California Building Code Sections 1014, 1015, and 11B-505.

C. Handrails:

1. Material: Schedule 40 steel pipe or round steel tubing of equivalent diameter and wall thickness of sizes indicated.
2. Diameter: As indicated on Drawings, 1-1/4 inch minimum, 2 inch maximum outside diameter.
3. Mounting Height: Design height of 36 inches (Code range of 34 inches minimum, 38 inches maximum), height measured vertically above the walking surface of ramps and/or walks, and the nosing of stair treads to the top of handrail gripping surfaces.
4. Handrails shall be continuous without breaks or interruptions for the length of the stair or ramp run, and include handrail extensions. The inside handrail of stairs and ramps that change direction shall be continuous between stair or ramp runs.
5. Handrail Extensions: Handrail extensions shall be in the direction of the stair or ramp run, and as follows:

    a. Stair Handrail Extensions:

        1) Upper Landings: Handrail extensions shall include a minimum 12 inch long horizontal (level) section of railing, exclusive of bends, extending beyond the top nosing.
        2) Lower Landings: Handrails shall continue to slope for a distance equal to one tread depth beyond the bottom tread nosing; the remainder of the extension shall include a minimum 12 inch long horizontal (level) section of railing, exclusive of bends.

    b. Ramp Handrail Extensions: Extensions shall include a minimum 12 inch long horizontal (level) section of railing, exclusive of bends, extending beyond the upper and lower limits of the ramp surface.
    c. Returns: Handrails shall return walls or the walking surface as indicated on Drawings; returns shall not be included in the length of horizontal extensions.

6. Finish:

    a. Interior Handrails: Prime paint.
    b. Exterior Handrails: Galvanize after fabrication.

D. Guards:

1. Material: Schedule 40 steel pipe or round steel tubing of equivalent diameter and wall thickness of sizes indicated.
2. Diameter: As follows unless otherwise indicated on Drawings:

a. Posts, and Top and Bottom Rails: 1-1/2 inch diameter schedule 40 pipe (1.9 inch outside diameter).
b. Intermediate Rails: 1 inch diameter schedule 40 pipe (1.6 inch outside diameter).

3. Height: As indicated on drawings and as follows:

a. 42 inches minimum measured vertically above the walking surface of ramps and/or walks, or the nosing of stair treads, to the top of guards.

1) Height may be reduced to 36 inches measured vertically above the walking surface of ramps, walks, or the nosing of stair treads, to the top of guards, where the upper walking surface is not more than 30 inches above the lower adjacent ground surface.

4. Openings: Openings between intermediate rails or panels, and between posts and adjacent construction, shall be such that a 4 inch diameter sphere shall not pass through any opening where the upper walking surface is more than 30 inches above the lower adjacent ground surface.
5. Bottom Rails: Provide bottom rails matching post size and material with the centerline located 3 inches (2 inches minimum/4 inches maximum) above the walking surface where curbs are not provided below guards.
6. Finish:

a. Interior Handrails: Prime paint.
b. Exterior Handrails: Galvanize after fabrication.

E. Post Sleeves: Where posts are indicated to be installed in sleeves, provide sleeves as detailed on Drawings; fabricate sleeves from steel pipe or tubing of length indicated and having an inside diameter not less than 1/2 inch greater than the outside diameter of the post; cap bottom of sleeves with a steel plate.

F. Connections: Fabricate railings with welded connections unless otherwise indicated.

G. Changes in Direction: Form changes in direction by bending or by inserting prefabricated elbows.

1. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

H. Close exposed ends of railing members with prefabricated end fittings.

I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated; Close ends of returns.

J. Handrail Surfaces: Grind and finish handrails and welds smooth to be free of sharp, rough, or abrasive surfaces.

K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. Provide crush-resistant fillers or other means to transfer loads through plaster or gypsum board wall finishes to structural supports to prevent bracket or fitting rotation and crushing of substrate.
2. Horizontal projections of handrail brackets shall provide 1-1/2 inch minimum clearance below the bottom of handrails (CBC 11B-505.6).
3. Handrail brackets shall provide 1-1/2 inch minimum clear between handrails and adjacent wall surfaces or other obstructions.

L. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

M. Expansion Control: Provide internal sleeves for continuous rails requiring provisions for expansion control.

2.11 ELEVATOR PIT LADDERS

A. Elevator pit ladders shall comply with ASME A17.1/CSA B44.

B. Elevator Pit Ladders:

1. Siderails: Continuous, 3/8-by-2-1/2 inch steel flat bars, with eased edges. Space side rails a minimum of 16 inches apart unless otherwise indicated.
2. Rungs: Minimum 3/4-inch diameter, steel bars.
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
5. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
6. Prime ladders, including brackets and fasteners, with zinc-rich primer.

2.12 ELEVATOR PIT SUMP COVERS

A. Elevator Sump Pit Covers: Fabricate from one of the following:

1. Fabricate from 1/8-inch rolled-steel floor plate with four 1-inch diameter holes for water drainage and for lifting.
2. Fabricate from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1 inch in least dimension.

B. Provide steel angle supports (1 X 1 inch) unless otherwise indicated to set in concrete so cover will be flush or 1/8 inch lower than top edge of sump and pit floor.

2.13 STEEL FINISHES

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

C. Galvanizing: Hot-dip galvanize exterior items and items indicated to be galvanized after fabrication to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

D. Shop Priming: Shop prime items not to be galvanized unless they are to remain unfinished or are embedded in concrete, or masonry, or unless otherwise indicated; shop prime galvanized items that are to receive field applied top coats.

1. Maintain identification markings of steel used for structural purposes until steel has been erected. Mill markings may be covered by shop priming provided the fabricator provides identification mark over the primer that can be traced through documentation.
2. Preparation of Surfaces:

a. Cleaning of Galvanized Items for Shop Priming: Where galvanized items are to receive field applied top coats, prepare for priming after galvanizing by thoroughly cleaning galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
b. Surface Preparation: Prepare surfaces to comply with the following:

1) Non-Galvanized Items:

a) Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
b) Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."

2) Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

3. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing and conditions by other Specification Sections where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports as indicated on Drawings and to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor support framing securely to, and rigidly brace from, building structure.

3.4 INSTALLING METAL BOLLARDS

A. Fixed Bollards Anchored in Concrete: Anchor bollards in place with concrete footings as indicated on Drawings; center and align bollards in holes 3 inches above bottom of excavation; place concrete and vibrate or tamp for consolidation; contour top surface of

concrete to slope/drain away from bollard; support and brace bollards in position until concrete has cured.

1. Fill bollards solidly with concrete, mounding top surface to shed water.

B. Removable Bollards Set in Sleeves: Anchor sleeves in place with concrete footings as indicated on Drawings; center and align sleeves in holes 3 inches above bottom of excavation; place concrete and vibrate or tamp for consolidation; contour top surface of concrete to slope/drain away from sleeves; support and brace sleeves in position until concrete has cured.

3.5 INSTALLING RAILINGS AND GUARDS

A. Railing and Post Connections, General: Use fully welded joints for permanently connecting components; comply with requirements for welded connections in Part 2 Articles "Fabrication, General" and “Railings and Guards” whether welding is performed in the shop or in the field.

1. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

B. Anchoring Posts in Concrete: Anchor posts as indicated on Drawings and as follows:

1. Sleeves: Clean holes of loose material, insert posts, and fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
2. Cored Holes in Concrete: Core-drill holes not less than 6 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
3. Cover anchorage joint with metal escutcheons.

C. Attaching Railings to Walls: Locate brackets as indicated or, if not indicated, at spacing required to support structural loads; equally space brackets. Attach railings to walls with wall brackets as indicated on Drawings and as follows:

1. Crush Sleeves: Install crush sleeves between brackets and structural support where fastening brackets to walls through gypsum board, cement plaster, and similar finish materials.
2. Secure wall brackets as follows:

    a. Concrete and Masonry Walls: Use post installed concrete anchors.
    b. Metal Stud Framed Walls: Use self-tapping screws fastened to steel framing or to concealed steel reinforcements; coordinate backing with steel framed partition work.

3.6 REPAIRS

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 055100

METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel framed stairs with concrete-filled metal pan treads and landings (AESS).

a. Guards and handrailings attached to metal stair stringers are specified in Division 05 Section “Decorative Stainless Steel Railings.”

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Division 05 Section “Structural Steel Framing” for structural steel framing supporting metal stairs.
3. Division 05 Section “Architecturally Exposed Structural Steel Framing” for architecturally exposed steel framing.
4. Division 05 Section “Metal Fabrications” for steel guards, railings and supports not included as components in metal stairs section 055100.
5. Division 05 Section “Decorative Stainless Steel Railings” for stainless steel railings, support posts and guards.

1.3 SUBMITTALS

A. Product Data: For manufactured products including primers and gout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate profile and dimensions of treads.
5. Indicate AESS fabrication, welds and primer/finish requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.5 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

    a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500.

D. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

F. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

G. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

2.2 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs or stairs indicated to be galvanized.

D. Post-Installed Anchors: Size and type as indicated on Drawings and as specified in Division 03 Section “Post Installed Concrete Anchors.”

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.3 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Comply with AWS requirements.

B. Shop Primers: Provide primers that comply with Division 09 Section “Painting.”

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi and maximum aggregate size of 1/2 inch unless otherwise indicated.

G. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated.

2.4 FABRICATION, GENERAL

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.

B. Provide complete stair assemblies, including metal framing, hangers, struts, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

C. Assemble stairs and railings in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

E. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Form exposed work with accurate angles and surfaces and straight edges.

G. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.5 FABRICATION OF STAIRS

A. Stair Framing:

1. Fabricate stringers of steel shapes and size as indicated on Drawings.

    a. Provide closures for exposed ends of channel and rectangular tube stringers.
    b. Finish: Shop primed.

2. Construct platforms of steel shapes and members as indicated on Drawings.

    a. Provide closures for exposed ends of channel and rectangular tube framing.
    b. Finish: Shop primed.

3. Weld stringers to headers; weld framing members to stringers and headers.

B. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Steel Sheet: Uncoated, cold-rolled steel sheet.
2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
3. Shape metal pans to include nosing integral with riser.
4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

    a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.6 FINISHES

A. Finish metal stairs after assembly.

B. Steel Shop Prime Finish:

1. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application

Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.7 SOURCE QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Provide testing and inspecting agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Testing and inspection agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Testing and Inspecting: Source Quality Control testing and inspection shall be as specified in Division 05 Section “Structural Steel Framing.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

F. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."

G. Install precast concrete treads according to manufacturer's written instructions.

3.3 INSTALLING RAILINGS AND GUARDS

A. Attach railings and guards to supporting construction as indicated on Drawings.

B. Attaching Railings to Walls: Locate brackets as indicated or, if not indicated, at spacing required to support structural loads; equally space brackets. Attach railings to walls with wall brackets as indicated on Drawings and as follows:

1. Crush Sleeves: Install crush sleeves between brackets and structural support where fastening brackets to walls through gypsum board, cement plaster, and similar finish materials.
2. Secure wall brackets as follows:

    a. Metal Stud Framed Walls: Use self-tapping screws fastened to steel framing or to concealed steel reinforcements; coordinate backing with steel framed partition work.

3.4 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Contractor Responsibilities:

1. The Contractor shall maintain control of the quality of materials and workmanship in order to conform with the drawings and specifications.
2. To facilitate testing and inspection, the Contractor shall:

    a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
    b. Provide access to the Work for the designated Testing and Inspection Agency.

c. Furnish all necessary materials and labor to assist the designated Testing and Inspection Agency in obtaining and handling samples at the project or other sources of materials.
d. Provide and maintain for the sole use of the Testing and Inspection Agency adequate facilities for safe storage test specimens on the project site.

3. The Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Testing and Inspecting: Field Quality Control testing and inspection shall be as specified in Division 05 Section “Structural Steel Framing.”

3.5 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, abraded areas of shop primers, and prime exposed areas with same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION

SECTION 055133

METAL LADDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fixed aluminum interior roof access ladders.
2. Telescoping safety posts for roof access ladders.

B. Related Sections include the following:

1. Division 07 Section "Roof Access Hatches" for roof access hatches.
2. Sections as applicable to wall framing for backing support for ladder anchorage concealed within other construction before ladder installation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, and finishes.

B. Shop Drawings: Include plans, elevations, sections, and details of ladders and their connections. Show anchorage to adjoining Work.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal ladders by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.5 COORDINATION

A. Coordinate installation of anchorages for metal ladders. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. OSHA Requirements: Comply with the following OSHA Requirements:

1. OSHA 1910.23, Ladders.
2. OSHA 1910.28, Duty to have fall protection and falling object protection.
3. OSHA 1910.29, Fall Protection Systems and falling object protection-criteria and practices.

B. ANSI: Comply with ANSI A14.3, Ladders - Fixed - Safety Requirements.

C. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Ferrous Metals:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: ASTM A 500, cold-formed steel tubing.
3. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

C. Nonferrous Metals:

1. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
3. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
4. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 ALUMINUM LADDERS

A. Manufacturer, Basis of Design: Where named manufacturer products are indicated, Design, Drawings and Specifications are based on products manufactured by the following:

1. O'Keeffe's Inc.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) ACL Industries, Inc.
2) Alco-Lite Industrial Products.
3) Precision Ladders, LLC.

B. Interior Roof Access Ladders:

1. Basis of Design: O'Keeffe's Inc.; Model 501 Heavy Duty Tubular Rail Fixed Access Ladder.

a. Mounting: Floor and wall mounting brackets.

b. Accessories:

1) Telescoping safety post.

C. Ladder Components and Fabrication: Ladder components and fabrication shall comply with the following:

1. Siderails:

a. Siderail Type: Channel type siderail, continuous extruded-aluminum channels or tubes, 3 inches by 1 inch by 1/8 inch material thickness.
b. Space siderails 18 inches minimum clear between rails, unless otherwise indicated.
c. Support each rail at top and bottom and not more than 60 inches on center with welded or bolted aluminum brackets.

1) Brackets shall locate the ladder such that the centerline of rungs shall not be closer than 7 inches to the finished wall surface.
2) Interior roof access ladders shall be floor and wall supported unless otherwise indicated.

2. Rungs: Extruded-aluminum tubes, 1 1/4 inches by 1-1/4 inches, 1/8 inch minimum material thickness, with ribbed surfaces, and capable of withstanding a 1,000 pound point load without deformation or failure.

    a. Fit rungs in centerline of siderails; fasten by stainless-steel fasteners, welding, or with brackets and aluminum rivets.
    b. Space rungs 12 inches on center alongside rails, 12 inches from top of roof access curb, and not more than 12 inches above the floor.

3. Finish: Mill finish.

2.4 TELESCOPING LADDER SAFETY POST

A. Ladder-Assist Post: Ladder manufacturer's standard device for attachment to interior roof-access ladders.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: Post extends to not less than 42 inches above top rung.
3. Material: Steel tube.
4. Post: 1-5/8-inch diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat finish.
6. Location: Provide at each interior roof access ladder.

2.5 FASTENERS

A. Provide Type 304 stainless-steel fasteners for fastening aluminum ladders to in-place construction; select fasteners for type, grade, and class required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine wall framing for backing to verify actual locations before ladder installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install ladders and accessories as indicated on Drawings and in accordance with manufacturer's written installation instructions. Install ladders level and plumb. Secure ladders in position with manufacturer's recommended anchoring devices.

B. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.3 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 055516

METAL STAIR NOSINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes extruded aluminum stair nosings for the following:

1. Interior concrete filled metal pan stairs.
2. Exterior cast-in-place concrete stairs.

B. Related Requirements:

1. Division 03 Section “Cast-in-Place Concrete” for cast-in-place concrete stairs.
2. Division 05 Section “Metal Stairs” for concrete filled metal pan stairs

1.3 ACTION SUBMITTALS

A. Product Data: For metal stair nosings.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.

C. Samples for Verification: For each type and finish of stair nosing.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Contrasting Stripe: Stair nosings shall comply with the contrasting stipe requirements of California Building Code Section 11B-504.4.1 as follows:

1. The stripe shall be a minimum of 2 inches wide to a maximum of 4 inches wide placed parallel to, and not more than 1 inch from the nose of the step or upper

approach. The stripe shall extend the full width of the step or upper approach and be of a material that is at least as slip resistant as the other treads of the stair.

2. Locations:

    a. Interior Stairs: Interior stairs shall have the upper approach and lower tread of each stair run marked by a stripe providing a clear visual contrast
    b. Exterior Stairs: Exterior stairs shall have the upper approach and all treads of each stair run marked by a stripe providing a clear visual contrast.

B. Nosing Profile: Nosing profile shall comply with California Building Code Section 11B-504.5 as follows:

1. The radius of the curvature at the leading edge of the tread shall be 1/2 inch maximum. (Note: This specification section is not intended to govern the design of treads and risers)

2.2 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

2.3 EXTRUDED ALUMINUM STAIR NOSINGS

A. Extruded Units: Extruded aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.

B. Manufacturer: Design, Drawings and Specifications are based on products by the following:

1. Babcock Davis.

    a. Subject to compliance with requirements, provide products indicated or equivalent products by one of

        1) American Safety Tread.
        2) Nystrom Building Products.
        3) Wooster Products, Inc.

C. Stair Nosing Type SN-1:

1. Use/Location: Exterior Cast-in-place concrete stairs.

    a. Provide nosing at nose of the top landing and the nose of each tread of each exterior stair run.

2. Basis of Design: Babcock Davis; BSTSB-C3E nosing.

3. Stair Nosing Characteristics:

    a. Configuration: Short tipped nose, square back edge, ribbed with abrasive filler.
    b. Width: 3 inches.
    c. Thickness: 5/16 inches.
    d. Aluminum Finish: Mill finish.
    e. Color of Abrasive Fill Color: As selected by Architect from manufacturer's standard colors, color to contrast with adjacent stair tread finish color.
    f. Installation Method: Integral anchor leg for embedment in concrete.
    g. Options: Painted underside.

4. Use/Location: Interior concrete filled metal pan stairs and landings.

    a. Provide nosing at nose of the top landing and nose of the bottom tread of each stair run.

5. Basis of Design: Babcock Davis; Model BSTSF-N2.25E.
6. Stair Nosing Characteristics:

    a. Configuration: Square-edge with full abrasive filler.
    b. Width: 2-1/4 inches.
    c. Thickness: 5/16 inches.
    d. Aluminum Finish: Mill finish.
    e. Color of Abrasive Fill Color: As selected by Architect from manufacturer's standard colors, color to contrast with adjacent stair tread finish color.
    f. Installation Method: Integral anchor leg for embedment in concrete.
    g. Options: Painted underside.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions, bearing surfaces, and locations of stair nosing installations for conditions detrimental to the Work of this section.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING METAL STAIR NOSINGS

A. Install metal stair nosings in accordance with manufacturer's written installation instructions.

1. Embedded Installation: Install stair nosings with anchors fully embedded in wet concrete.
2. Mechanically Fastened Installation: Install mechanically fastened stair nosings with fasteners as recommended by stair nosing manufacturer.
3. Install nosings to comply with accessibility requirements.

B. Fit exposed connections accurately together to form hairline joints.

END OF SECTION

SECTION 055800

FORMED METAL COVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manufactured exterior formed metal column covers.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for non-decorative metal fabrications.
2. Division 07 Section "Sheet Metal Flashing and Trim" for items made of formed metal for non-decorative flashings and trim.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include finishing materials.

B. Shop Drawings: Show fabrication and installation details for formed metal products.

1. Include plans, elevations, component details, and attachment details.
2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

C. Samples: For each type of exposed finish required, prepared on 6-inch square samples of metal of same thickness and material indicated for the Work.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build one mockup of each type of formed metal product as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

B. Store products on elevated platforms in a dry location.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with formed metal products by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate installation of anchorages for formed metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Decorative formed metal items, including anchors and connections, shall withstand the effects of gravity loads and the following loads and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components:

B. Wind Loads on Exterior Items: As indicated on Drawings, not less than 27.5 lbf/sq. ft. (Strength Design LRFD).

C. Seismic Performance: Exterior decorative formed metal items, including anchors and connections, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7, Component Importance Factor of 1.0.

D. Thermal Movements, Exterior Items: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects; allow for temperature change of 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Basis of Design Manufacturer: Where named products are indicated, design, Drawings and Specifications are based on products manufactured by the following:

1. Pittcon Industries.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) C.R. Laurence Company.

2) Fry Reglet Corporation.
3) Gordon Incorporated.
4) MM Systems Corporation.
5) Peterson Aluminum Corporation

2.3 COLUMN COVERS

A. Exterior Column Covers: Two-piece formed metal column covers as follows:

1. Basis of Design: Pittcon Industries; Series 300 Rod and Caulk Stainless Steel Column Covers.
2. Product Characteristics:

a. Configuration: Square, size as indicated on Drawings.
b. Length: Up to 16 feet without horizontal joints.

1) Fabricate column covers without horizontal joints unless required length exceeds manufacturing capabilities.
2) Where horizontal joints are required, fabricate column covers with horizontal butt joints, tightly fitted and backed with a sleeve for field splicing with adhesive.

c. Vertical Joints: Vertical joints to provide 5/8-inch-wide reveal at joints to accommodate backer rod and sealant.
d. Fabricate base and ceiling rings to match column covers.

2.4 CLOSURES AND TRIM

A. Form closures and trim from metal of type and finish matching beam and column covers of thickness indicated below. Fabricate to fit tightly to adjoining construction. Joints of exterior installations shall be weather tight. Materials to be of the following thicknesses:

1. Stainless Steel Sheet: 0.048 inch minimum thickness.

B. Conceal fasteners where possible; otherwise, locate where they are as inconspicuous as possible. Size fasteners to support closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.

C. Drill and tap holes needed for securing closures and trim to other surfaces.

D. Incorporate gaskets where indicated or needed for concealed, continuous seal at abutting surfaces.

E. Miter or cope trim members at corners and reinforce with bent metal splice plates to form tight joints.

2.5 METAL MATERIALS

A. General: Provide metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.

B. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

2.6 MISCELLANEOUS MATERIALS

A. Sealants, Exterior: Silicone or Polyurethane sealants as specified in Division 07 Section “Joint Sealants.

B. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.

1. Provide concealed fasteners for interconnecting formed metal items and for attaching them to other work unless exposed fasteners are unavoidable.
2. Provide tamper-resistant machine screws for exposed fasteners unless otherwise indicated.

C. Backing Materials: Provided or recommended by metal cover manufacturer.

D. Isolation Coating: Bituminous paint as recommended by Metal cover manufacturer.

2.7 FABRICATION, GENERAL

A. Coordinate dimensions and attachment methods of column covers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.

B. Form to profiles indicated, in maximum lengths to minimize joints. Produce flush surfaces without cracking or grain separation at bends.

C. Reinforce column covers with concealed stiffeners, backing materials, or both, as needed to provide sufficient strength for indicated use.

1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

D. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.

2.8 GENERAL FINISH REQUIREMENTS

A. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

C. Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work specified in this section.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install formed metal products in accordance with manufacturer’s written installation instructions and approved shop drawings.

B. Locate and place beam and column covers level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install covers.

1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

C. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.

D. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.

E. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior decorative formed metal items weatherproof.

F. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses, to make interior decorative formed metal items soundproof or lightproof as applicable to type of fabrication indicated.

G. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 CLEANING

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

A. Protect finishes of formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 057300
DECORATIVE STAINLESS STEEL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior and exterior stainless steel decorative railings and brackets.
2. Stainless steel guards and guard infill bars.

B. Related Requirements:

1. Division 03 Section “Post Installed Concrete Anchors” for post installed concrete anchors.
2. Division 05 Sections “Metal Fabrications” and “Metal Stairs” for railings, support posts and guards other than stainless steel decorative railings as indicated on drawings.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of decorative stainless steel railings and other stainless steel support posts, guards and infill bars (where indicated), assembled from standard components.
2. Fasteners.
3. Post-installed anchors.
4. Handrail brackets.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters
2. Welded connections and finishing of welds.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, and handrail. Sample need not be full height.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

B. Mockups: Build mockups to verify selections made under submittals to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup as directed by Architect. Mockup shall be full scale and consist of a corner condition of not less than three posts, top rail, infill area, and anchorage system components.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.2 DECORATIVE STAINLESS STEEL RAILINGS

A. Source Limitations: Obtain decorative stainless steel railing components from single source from single manufacturer.

B. Tubing: ASTM A554, Grade MT 304.

C. Pipe: ASTM A312/A312M, Grade TP 304.

D. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

E. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. .

F. Flat Bar: ASTM A666, Type 304.

G. Bars and Shapes: ASTM A276/A276M, Type 304.

2.3 FASTENERS

A. Fastener Materials:

1. Stainless Steel Railing Components: Type 304 stainless steel fasteners.
2. Ungalvanized-Steel Railing Components: Plated-steel fasteners complying with ASTM F1941/F1941M, Class Fe/Zn 5 for electrodeposited zinc coating where concealed; Type 304 stainless steel fasteners where exposed.
3. Hot-Dip Galvanized-Steel Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
4. Dissimilar Metal Railing Components: Type 304 stainless steel fasteners.
5. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable or exposed fasteners are the indicated fastening method for railings.

1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Post-installed anchors shall be as specified in Division 03 Section “Post Installed Fasteners.”

1. Material: Alloy Group 1 stainless steel bolts, ASTM F593 and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Stainless steel of type indicated on Drawings.

1. Horizontal projections of handrail brackets shall be 1-1/2 inches minimum clear below the bottom of handrails (CBC 11B-505.6).
2. Handrails shall be located to have 1-1/2 inch minimum clear between handrails and adjacent wall surfaces or other obstructions (CBC 11B-505.5).
3. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION

A. Fabricate railings as indicated on Drawings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

1. Handrails, guards, and infill rails or panels shall comply with the California Building Code Sections 1014, 1015, and 11B-505.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

I. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings.

1. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
2. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form changes in direction as detailed.

K. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated, close ends of returns.

N. Surfaces: Grind and finish stainless steel surfaces and welds smooth to be free of sharp, rough, or abrasive surfaces.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. Provide crush-resistant fillers or other means to transfer loads through plaster or gypsum board wall finishes to structural supports to prevent bracket or fitting rotation and crushing of substrate.

P. Expansion Control: Provide internal sleeves for continuous rails requiring provisions for expansion control.

Q. Provide inserts and other anchorage devices for connecting railings to concrete or masonry Work.

1. Coordinate anchorage devices with supporting structure.

R. Handrails:

1. Material: Stainless steel Schedule 40 pipe or round tubing of equivalent diameter and wall thickness of sizes indicated.
2. Outside Diameter: As indicated on Drawings (Accessibility requirement range of 1-1/4 inch minimum, 2 inch maximum).
3. Mounting Height: Design height of 36 inches (Accessibility requirement range of 34 inches minimum, 38 inches maximum), height measured vertically above the walking surface of ramps and/or walks, and the nosing of stair treads to the top of handrail gripping surfaces.
4. Handrails shall be continuous without breaks or interruptions for the length of the stair or ramp run, and include handrail extensions. The inside handrail of stairs and ramps that change direction shall be continuous between stair or ramp runs.
5. Handrail Extensions: Handrail extensions shall be in the direction of the stair or ramp run, and as follows:

a. Stair Handrail Extensions:

1) Upper Landings: Handrail extensions shall include a minimum 12 inch long horizontal (level) section of railing, exclusive of bends, extending beyond the top nosing.
2) Lower Landings: Handrails shall continue to slope for a distance equal to one tread depth beyond the bottom tread nosing; the remainder of the extension shall include a minimum 12 inch long horizontal (level) section of railing, exclusive of bends.

b. Ramp Handrail Extensions: Extensions shall include a minimum 12 inch long horizontal (level) section of railing, exclusive of bends, extending beyond the upper and lower limits of the ramp surface.
c. Returns: Handrails shall return walls or the walking surface as indicated on Drawings; returns shall not be included in the length of horizontal extensions.

S. Guards:

1. Vertical Supports: Stainless steel of size and profile indicated on Drawings.
2. Top Rail: Stainless steel Schedule 40 pipe or round tubing of diameter and wall thickness indicated on Drawings, or square shapes with 1/8 inch radius corners where indicated on Drawings.
3. Height: As indicated on drawings, 42 inches minimum measured vertically above the walking surface or of the nosing of stair treads, to the top of guards where the walking surface and/or stair tread height exceeds 30 inches above the adjacent lower grade.
4. Openings: Openings between vertical supports and adjacent construction shall be such that a 4 inch diameter sphere shall not pass through any opening where the upper walking surface is more than 30 inches above the lower adjacent ground surface.

2.6 STAINLESS STEEL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

D. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

E. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces.
3. Remove embedded foreign matter and leave surfaces chemically clean.

F. Stainless Steel Tubing Finishes:

1. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.

G. Stainless Steel Sheet and Plate Finishes:

1. Directional Satin Finish: ASTM A480/A480M, No. 4.

2.7 SOURCE QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Provide testing and inspecting agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Testing and inspection agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Testing and Inspection Services: Testing and inspections shall be performed by the designated Testing and Inspection Agency.

1. Testing and inspections shall be in accordance with the 2022 California Building Code, Section 1705A.2 and DSA Testing and Inspections form DSA 103.
2. Special inspection of railing systems shall be limited to welding inspection of welds at the base of cantilevered posts (Reference CBC 1705A.2.1, Exception).
3. Inspection of Welding: Shop welding operations shall be inspected by a certified Welding Inspector meeting the requirements of AWS QC1. The Fabricator shall schedule their operations to provide a minimum of 24 hours notice to the welding inspector so that all welding operations may be inspected.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION

A. Install railings as indicated on the Drawings, per approved shop drawings, and in compliance with Part 2 Article “Fabrication.”

B. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.

4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners as indicated on Drawings and where necessary for securing railings and for properly transferring loads to in-place construction.

E. Railing Connections:

1. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.
2. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
3. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.3 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Contractor Responsibilities:

1. The Contractor shall maintain control of the quality of materials and workmanship in order to conform with the drawings and specifications.
2. To facilitate testing and inspection, the Contractor shall:

a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.

b. Provide access to the Work for the designated Testing and Inspection Agency.
c. Furnish all necessary materials and labor to assist the designated Testing and Inspection Agency in obtaining and handling samples at the project or other sources of materials.

3. The Contractor shall correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Testing and Inspection Services: Testing and inspections shall be performed by the designated Testing and Inspection Agency.

1. Testing and inspections shall be in accordance with the 2022 California Building Code, Section 1705A.2 and DSA Testing and Inspections form DSA 103.
2. Special inspection of railing systems shall be limited to welding inspection of welds at the base of cantilevered posts (Reference CBC 1705A.2.1, Exception).
3. Inspection of Welding: Shop welding operations shall be inspected by a certified Welding Inspector meeting the requirements of AWS QC1. The Fabricator shall schedule their operations to provide a minimum of 24 hours notice to the welding inspector so that all welding operations may be inspected.

E. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.

F. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.4 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.5 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 057500

FORMED DECORATIVE METAL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Decorative formed metal panels at soda fountain.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for non-decorative metal fabrications.
2. Division 05 Section "Formed Metal Covers" for decorative metal column covers.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include finishing materials.

B. Shop Drawings: Show fabrication and installation details for formed metal products.

1. Include plans, elevations, component details, and attachment details.
2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

C. Samples for Initial Selection: For each type of exposed finished.

D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch-square Samples of metal of same thickness and material indicated for the Work.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated and employing competent control personnel to

conduct continuing, effective quality-control program to ensure compliance with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver formed metal products wrapped in protective coverings. Remove protective coverings before they stain or bond to finished surfaces.

B. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Aluminum:

1. Bars and Shapes: ASTM B221, Alloy 6063-T5/T52.
2. Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
3. Tubing: ASTM B210, Alloy 6063-T832.
4. Plate and Sheet: ASTM B209, Alloy 3003-H14, 5005-H32 or 6061-T6.

2.2 FASTENERS

A. Fastener Materials: Type 304 stainless steel, oval head Phillips screws.

2.3 FABRICATION

A. Fabricate decorative metal panels to sizes indicated on Drawings.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Provide necessary brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.

D. Comply with AWS for recommended practices in shop welding. Clean exposed welded joints of flux, and dress exposed and contact surfaces.

1. Finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 Welds: completely sanded joint, some undercutting and pinholes okay.

2.4 ALUMINUM FINISHES

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

C. Powder-Coat Finish: AAMA 2604 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work specified in this section.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install formed decorative metal fabrications in accordance approved shop drawings and as indicated on Drawings.

B. Install fabrications level and plumb and in alignment with adjacent construction.

1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

3.3 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean installed fabrications by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

C. Protect installed fabrications from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 061053
MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Wood blocking, sleepers, nailers and grounds used in conjunction with roofing and flashing.
2. Plywood backing panels for telecommunications equipment rooms.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inch nominal or greater but less than 5 inches nominal in least dimension.

B. Timber: Lumber of 5 inches nominal or greater in least dimension.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Research/Evaluation Reports: From ICC-ES or IAPMO ES, for the following:

1. Wood-preservative-treated wood.
2. Power-driven fasteners.
3. Powder-actuated fasteners.
4. Post installed concrete anchors.

1.5 REFERENCED CODES AND STANDARDS

A. California Code of Regulations, Title 24, Part 2, California Building Code, 2022 Edition.

B. American Wood Council (AWC):

1. National Design Specification for Wood Construction with commentary, September 30, 2014 (ANSI/AWC NDS-2018).
2. Special Design Provisions for Wind and Seismic with commentary, September 8, 2014 (ANSI/AWC SDPWS-2015).

C. Lumber grading agencies and abbreviations:

1. NLGA: National Lumber Grades Authority.
2. WCLIB: West Coast Lumber Inspection Bureau.
3. WWPA: Western Wood Products Association.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stockpile materials sufficiently in advance of need to assure their availability in a timely manner for Work.

B. Use extreme care in off-loading of lumber to prevent damage, splitting, and breaking of materials.

C. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

D. Identify framing lumber by grade, and store each grade separately from other grades.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S, unless otherwise indicated.

B. Moisture Content of Lumber: 19 percent maximum unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1, Use Category UC3b for exterior construction not in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 DIMENSION LUMBER

A. General: Provide dimension lumber as indicated on Drawings and as required for project conditions, including but not limited to blocking and nailers associated with roofing and flashing.

B. Dimension Lumber: Douglas Fir, WCLIB or WWPA, No. 1 or better, unless otherwise indicated on Drawings.

2.4 PLYWOOD EQUIPMENT BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C (‘A’ face exposed to room), 3/4 inch nominal thickness.

1. Equipment backing panels to be finished with intumescent paint specified in Division 09 Section Painting or panels shall be fire retardant treated plywood.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Fasteners in contact with preservative treated wood, including nuts and washers, shall be of hot dipped galvanized steel, stainless steel, or silicon bronze; the coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153. Fasteners other than nails, timber rivets, wood screws, and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum; comply with requirements of 2022 CBC 2304.10.5.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.6 METAL FRAMING ANCHORS AND HARDWARE

A. General: Connectors in contact with preservative treated or fire retardant treated wood shall be of hot dipped galvanized steel or stainless steel; the coating weights for zinc-coated connectors shall be in accordance with ASTM A 153; comply with requirements of 2022 CBC 2304.10.5.

B. Basis of Design Manufacturer: Provide products as indicated on Drawings manufactured by the following:

1. Simpson Strong-Tie Co., Inc.

C. Material: Galvanized steel sheet, hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

2.7 MISCELLANEOUS MATERIALS

A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install blocking and nailers as indicated on Drawings and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach blocking and nailers to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

F. Securely attach lumber to substrate by anchoring and fastening as indicated on Drawings and complying with the following:

1. ICC ESR-1539 for power-driven staples and nails.
2. 2022 CBC Table 2304.10.1 “Fastening Schedule.”

G. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

H. Fasteners and connectors in contact with preservative treated or fire retardant treated wood shall be corrosion resistant as specified under Part 2 product requirements.

I. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install plywood backing panels with classification marking of testing agency exposed to view.

3.2 PROTECTION

A. Use all necessary means to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to, the approval of the Architect and at no additional cost to the Owner.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 061643
EXTERIOR GYPSUM SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior glass mat faced gypsum wall sheathing.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for steel framing and supports.
2. Division 07 Section “Weather Resistive Barriers” for weather resistant barriers applied over sheathing.
3. Division 09 Section “Portland Cement Plaster” for exterior wall finish.
4. Division 09 Section “Gypsum Board” for interior gypsum board applications.

1.3 SUBMITTALS

A. Product Data: For sheathing and accessories.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and keep dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat with spacers between each bundle to provide air circulation and to prevent sagging. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 EXTERIOR GYPSUM SHEATHING

A. Source Limitations: Obtain each type of product through one source from a single manufacturer.

B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corporation.
2. Type and Thickness: Type X, 5/8 inch thick unless otherwise indicated.
3. Size: 48 by 96, 108 or 120 inches.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions with Installer present for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Coordinate installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

F. Weather Resistive Barrier: A weather resistive barrier is to be installed over wall sheathing; weather resistive barrier and installation is specified in Division 7 Section “Weather Resistive Barriers.”

3.3 INSTALLATION OF GYPSUM SHEATHING

A. Comply with GA-253, ASTM C 1280 and with manufacturer's written instructions.

B. Fasten gypsum sheathing to framing with screws. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.

D. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

E. Install panels horizontally or vertically, center vertical joints on studs, stagger end joints of adjacent boards of horizontal applications not less than one stud spacing, stagger end joints of adjacent boards of vertical applications not less than 2 feet. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches on center and set back a minimum of 3/8 inch from edges and ends of boards.

F. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes until work is concealed.

B. Remove and replace damaged panels.

END OF SECTION

SECTION 062023

INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior composite board siding and related trim.

B. Related Sections include but are not limited to the following:

1. Division 06 Section "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Division 06 Section “Architectural Wood Trim” for wood trim not included in this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product, include material descriptions, dimensions of individual components and profiles, textures and finishes.

B. Samples for Initial Selection: Samples or manufacturer’s color charts for composite wood boards.

C. Samples for Verification: For each type, color, texture, and pattern required; 12-inch long-by-actual-width sample of siding or 12 inch square panel.

D. Research/Evaluation Reports: For each type of composite siding, from ICC-ES.

E. Sample Warranty: For special warranty.

F. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall have experience installing products similar to those required for this Project and have a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack composite wood products flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

B. Deliver materials only when environmental conditions comply with requirements specified for installation areas. If materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking and deforming.
b. Deterioration of materials beyond normal weathering.

2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPOSITE BOARD SIDING

A. Composite Board Siding: Wood and plastic composite core boards with a patented polyethylene-based capping material for superior stain, fade, and scratch resistance. Manufactured through a continuous co-extrusion process.

1. Basis of Design: Design, Drawings and Specifications are based on the following:

a. Fiberon; Wildwood Cladding.

1) Subject to compliance with requirements, provide product indicated or a comparable product subject to substitution request per Division 01 Section “Substitution Procedures.”

2. Characteristics:

a. Size: 1 inch by 6 inch nominal, 0.75 inch by 6.0 inch actual.
b. Length: 12, 16 and 20 foot available lengths.
c. Surface Texture: Wood grain 3 sides, Eden Collection (Tight grain) or Sahara Collection (Open grain) as selected by Architect.
d. Backs: Flat.
e. Color: As selected by Architect from manufacturer's full range.
f. Surface Burning Characteristics. Class B, ASTM E 84

1) Flame Spread Index: 26 – 75 (65 per product data).
2) Smoke Developed Index: 0 – 450 (200 per product data).

2.2 ACCESSORIES

A. Trim and Accessories: Provide edge trim and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Fasteners: As recommended in writing by cladding manufacturer for fastening to metal framing. Provide fasteners matching color composite boards.

1. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.

a. Use products having a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

1. Use products having a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Installation shall comply with Woodwork Institute “North American Architectural Woodwork Standards” (NAAWS), latest edition, Section 8 “Wall Surfacing.”

1. Grade: Custom.

B. Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Cut boards using only carbide-tipped blades, to preclude frayed edge cuts.
3. Predrill holes located closer than 1-1/2 inches from ends of boards and 1 inch from board edges. Pre-drill holes in cladding boards three inches wide or less.
4. Install fasteners at spacings recommended by manufacturer, and no more than 24 inches on center.
5. Align exposed fasteners vertically and horizontally and uniformly space fasteners.

C. Install board paneling level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut interior finish carpentry to fit adjoining work.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Fasten paneling with trim screws, set below face and filled.

D. Install boards horizontally and space boards 1/4 inch or as indicated on drawings.

E. Install boards in continuous lengths. If lengths exceed maximum available board length, stagger joints from joints in adjacent boards not less than 4 feet.

F. Trim: Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available.

1. Do not use pieces less than 24 inches long, except where necessary.
2. Stagger joints in adjacent and related standing and running trim.
3. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint.
4. Use scarf joints for end-to-end joints.
5. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
6. Fasten to prevent movement or warping.
7. Countersink fastener heads on exposed carpentry work and fill holes.

3.4 REPAIR

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

3.5 CLEANING AND PROTECTION

A. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

B. Protect installed products from damage from weather and other causes during remainder of the construction period.

END OF SECTION

SECTION 064116

PLASTIC LAMINATE CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate faced architectural cabinets.
2. Plastic-laminate countertops.
3. Plastic-laminate countertops with chemical resistant laminates or other solid surface type countertops as indicated in drawings.
4. Closet and utility shelving.

B. Related Sections:

1. Division 06 Section “Rough Carpentry” for blocking required for installing cabinets and concealed within other construction before cabinet installation.
2. Division 06 Section "Architectural Wood Trim" for interior standing and running wood trim and paneling exposed to view that is not specified in this Section.
3. Division 05 Section “Cold Formed Metal Framing” for backing required for installing cabinets and concealed within other construction before cabinet installation.
4. Division 12 Section “Quartz Countertops” for quartz countertops where indicated in drawings.

1.3 SUBMITTALS

A. Product Data: For each type of product, including cabinet hardware and accessories.

1. Provide documentation VOC content for adhesives.
2. Provide documentation that wood panel products and bonding adhesives contain no urea formaldehyde.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.

3. Apply WI-certified compliance label to first page of Shop Drawings.

C. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.

D. Samples for Verification:

1. Plastic Laminate and Edge Banding: One sample, 8 by 10 inches, for each type, color, pattern, and surface finish with sample applied to core material and specified edge material applied to 1 edge.
2. Cabinet hardware, one unit for each type and finish of the following:

a. Pulls.
b. Hinges.
c. Catches.
d. Locks.
e. Shelf supports.

E. Woodwork Quality Standard Compliance Certificates: WI-certified compliance certificates.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project, who are familiar with Woodwork Institute fabrication requirements, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Installer shall be fabricator of plastic laminate casework or fabricator shall be responsible for the Work of the installer. Installers shall be skilled workers who are experienced installing products similar to those required for this Project, who are familiar with Woodwork Institute installation requirements, and have a record of successful in-service performance.

C. Woodwork Institute (WI) Quality Assurance Program: Plastic Laminate Casework shall be subject to the following WI quality assurance program:

1. Certified Compliance Program (CCP):

a. A WI Certified Compliance Label shall be affixed to the first page of the original shop drawing set.
b. A WI Certified Compliance Certificate shall be issued for plastic laminate cabinets, counter tops and installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver casework until painting and similar operations that could damage casework have been completed in installation areas. If casework must be stored in

other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Requirements: Comply with WI construction methods for seismic design for schools and hospitals.

B. Regulatory Requirements, Accessibility: Casework shall comply with accessibility requirements of the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) 2010 ADA Standards for Accessible Design and with the 2022 California Building Code, Chapter 11B, “Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.” Accessible casework shall comply with the following:

1. Counter Top Heights for Sinks and Lavatories: Where self-rimming sinks or lavatories are installed in counter tops and the fixtures are indicated to be accessible, counter top heights shall be verified and coordinated so that the top rim of sinks and lavatories shall not be more than 34 inches above the finished

floor; for self-rimming sinks, counter top heights shall be set at +33-1/2 inches above the finish floor level.

2. Knee and Toe Space at Sink Counter Tops (Ref. CBC 11B-306):

    a. Width: 30 inches minimum clear width.
    b. Vertical Clearance: 27 inches minimum at the front edge of counter tops.
    c. Depth of Knee and Toe Clearance: Measured from the front edge of counter tops.

        1) Depth at Floor Level: 19 inches minimum / 25 inches maximum; and not less than the reach depth over the counter top.
        2) Depth at +9 Inches: Depth at floor level less 6 inches maximum (13 inches minimum depth at +9 inches for a clear space depth of 19 inches at floor level; depth increases as depth at floor level increases).
        3) Depth at +27 Inches: Depth at floor level less 9 inches maximum (10 inches minimum depth at +27 inches for a clear space depth of 19 inches at floor level; depth increases as depth at floor level increases).

3. Knee and Toe Space at Lavatory Counter Tops (Ref. CBC 11B-306):

    a. Width: 30 inches minimum clear width.
    b. Vertical Clearance: 29 inches minimum at the front edge of counter tops.
    c. Depth of Knee and Toe Clearance: Measured from the front edge of counter tops.

        1) Depth at Floor Level: 17 inches minimum / 19 inches maximum; and not less than the reach depth over the counter top; actual depth may exceed 19 inches although it may not be considered as additional accessible toe space.
        2) Depth at +9 Inches: Depth at floor level less 6 inches maximum (11 inches minimum depth at +9 inches for a clear space depth of 17 inches at floor level; depth increases as depth at floor level increases).
        3) Depth at +27 Inches: Depth at floor level less 9 inches maximum (8 inches minimum depth at +27 inches for a clear space depth of 17 inches at floor level; depth increases as depth at floor level increases).

4. Side Reach Depth Over Counter Tops (Ref. CBC 11B-308.3.2): Where casework is to be accessible, casework shall be fabricated such that the side reach depth does not exceed 24 inches measured from the front edge of the counter top to the finished surface of the wall at the back of the counter top. Counter top heights shall not exceed 34 inches from the finished floor surface.

C. Quality Standard: Unless otherwise indicated, comply with Woodwork Institute's (WI) "North American Architectural Woodwork Standards" (NAAWS), latest edition, for grades of architectural plastic-laminate cabinets and counter tops indicated for construction, finishes, installation, and other requirements.

D. Seismic Design: Fabrication shall comply with referenced seismic design requirements.

2.2 PLASTIC-LAMINATE CABINETS

A. Quality Standard: Unless otherwise indicated, comply with WI's "North American Architectural Woodwork Standards," latest edition, Section 10 "Casework" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. Grade: Custom Grade except where Premium Grade requirements indicated.
2. Provide labels and certificates from the Woodwork Institute (WI) certification program indicating that woodwork, including installation, complies with requirements of grades specified.
3. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard indicated.

B. Fabricate casework as multiple self-supporting units rigidly joined together or as single-length sections to fit access openings.

1. Cabinet bodies shall be fabricated using dowel and confirmat screw construction with glued joints.

C. Type of Construction: Type A, Frameless.

D. Cabinet, Door, and Drawer Front Interface Style: Style 1, flush overlay.

E. Laminate Cladding for Exposed Exterior and Exposed Interior Surfaces: NEMA LD 3, High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGL (1.0 mm).
2. Postformed Surfaces: Grade HGP (1.0 mm).
3. Vertical Surfaces: Grade VGS (0.7 mm).
4. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.

F. Materials for Semi-exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
    a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
    b. For semi-exposed backs of doors and other semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS and matching color of exposed surfaces.
2. Drawer Sides and Backs: Thermoset decorative panels with PVC edge banding, 1/2 inch minimum thickness.
3. Drawer Bottoms: Thermoset decorative panels, 1/2 inch minimum thickness.

G. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL. Backs shall be 1/2 inch minimum thickness and mechanically fastened to cabinet bodies.

H. Security Dust Panels: Provide 3/4-inch thick security dust panels above lockable drawers, unless located directly under tops.

I. Shelves: Shelves shall be adjustable and supported by shelf standards and clips.

1. Design loading: 50 psf.
2. Maximum Width: 48 inches for concealed shelves, 42 inches for exposed shelves.
3. Thickness: 3/4 inch minimum, shelves 30 inches or more in width shall be 1-inch minimum thickness.

J. Hinges: Doors 80 inches or more in height shall be provided with four (4) hinges.

K. Locks, Doors and Drawers: All doors and drawers shall be provided with locks.

L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid colors, matte finish.
b. Wood grains, matte finish.
c. Patterns, matte finish.

2.3 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with WI's "North American Architectural Woodwork Standards," latest edition, Section 11 "Countertops" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. Grade: Premium Grade.
2. Provide labels and certificates from the Woodwork Institute (WI) certification program indicating that woodwork, including installation, complies with requirements of grades specified.
3. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard indicated.

B. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS or HGP as required for post-formed counter tops.

C. Where indicated in drawings, provide Chemical-Resistant, High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP or other solid surface type countertops as indicated in drawings.

D. Colors and Pattern: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range in the following categories:

a. Solid colors, matte finish.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

1. Splash: Integral cove splash with square top, 4 inches high unless otherwise indicated.
2. Front Edge: Full round edge unless otherwise indicated.

a. Square self-edge where full round edge cannot be used due to fabrication limitations.

F. Core Material: Particleboard, 3/4 inch thick; counter tops for sinks to be particleboard made with exterior glue.

G. Counter Top Edge Thickness: Build up counter top edge thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

H. Backer Sheet: Provide paper backing on underside of countertop substrate.

I. Cutouts: Edges of cut outs shall be sealed per WI Custom Grade requirements with a color toned water resistant varnish before sink or rims are installed.

2.4 CLOSET AND UTILITY SHELVING

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

B. Grade: Custom.

C. Shelf Material: 3/4-inch thermoset decorative panel with 0.12 inch (3 mm) PVC edge banding.

D. Cleats: 3/4-inch solid lumber.

2.5 MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Panel Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated. Provide products containing no urea formaldehyde complying with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
4. Softwood Plywood: DOC PS 1, Medium Density Overlay.

C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:

   a. Formica Corporation.
   b. Nevamar Company, LLC; Decorative Products Div.
   c. Wilsonart International; Div. of Premark International, Inc.

2. Plastic laminate colors and patterns shall not be allowed to be selected from manufacturer’s discontinued stock.

E. Where indicated in drawings, provide Chemical-Resistant, High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP, and as follows:

1. Laminate has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.9.5:

   a. Nitric Acid (30 Percent): Moderate effect.
   b. Sulfuric Acid (77 Percent): Moderate effect.
   c. Hydrochloric Acid (37 Percent): Moderate effect.
   d. Phosphoric Acid (75 Percent): No effect.
   e. Acetic Acid (98 Percent): No effect.
   f. Formaldehyde: No effect.
   g. Ethyl Acetate: No effect.
   h. Ethyl Ether: No effect.
   i. Phenol (85 Percent): Moderate effect.
   j. Benzene: No effect.
   k. Xylene: No effect.
   l. Butyl Alcohol: No effect.
   m. Furfural: No effect.
   n. Methyl Ethyl Ketone: No effect.
   o. Sodium Hydroxide (25 Percent): No effect.
   p. Sodium Sulfide (15 Percent): No effect.
   q. Ammonium Hydroxide (28 Percent): No effect.
   r. Zinc Chloride: No effect.

s. Gentian Violet: No effect.
t. Methyl Red: No effect.

2. Products: Subject to compliance with requirements, provide one of the following:

a. Formica Corporation; Chemtop2.
b. Wilsonart International, Div. of Premark International, Inc.; Chemsurf.

F. Tempered Float Glass for Cabinet Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.

G. Tempered Float Glass for Cabinet Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3; with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.

2.6 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets and complying with ANSI/BHMA Grade 1 performance requirements.

B. Overlay Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095-inch thick metal, with hospital tips; ANSI/BHMA 156.9, Grade 1.

1. Manufacturer/Product: Rockford Process Control (RCP) RP-376 or equivalent.

C. Wire Pulls: Back mounted, solid stainless steel or aluminum bent wire pulls, 4 inches long, 5/16 inch in diameter, 1-1/2 inch projection.

1. Manufacturer/Product: Doug Mockett and Company, Inc.; DP57B or equivalent.

D. Catches: Magnetic catches with aluminum body, 5 lb maximum pull load, ANSI/BHMA A156.9.

1. Manufacturer/Product: Ives, No. 325 or equivalent.

E. Drawer Slides: Ball bearing, full extension, side mounted; zinc-plated-steel ball-bearing slides ANSI/BHMA A156.9; Grade 1HD-100 and Grade 1HD-200.

1. Grade 1 HD-200, 200 lb capacity, for drawers more than 8 inches high or more than 24 inches wide.
2. Manufacturers: Accuride, Knape & Vogt, Grass, or equivalent.

F. Adjustable Shelf Standards and Supports: Steel standards and supports with zinc plated finish, ANSI/BHMA A156.9.

1. Manufacturer/Product: Knape & Vogt; No. 255 Supports with No. 256 clips.
2. Provide seismic restraint pins in back row or notch shelf.

G. Locks: Pin tumbler locks.

1. Cabinet Door Locks: ANSI/BHMA A156.11, E07121.
2. Cabinet Drawer Locks: ANSI/BHMA A156.11, E07041.
3. Manufacturer: CompX/National.
4. Keying: Confirm keying with Owner’s lock personnel.

H. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

I. Grommets for Cable Passage through Countertops: Molded-plastic grommet with minimum 1-1/2-inch diameter cord opening with slotted cap, black.

1. Manufacturer/Product: Doug Mockett & Company, Inc.; "SG series."

J. Glass Door Locks:

1. KV965 for glass door panels less than 16 square feet in area.
2. National C-8140 pin tumbler for glass door panels 16 square feet or larger in area.

K. Sliding Glass Door Track:

1. KV 1092 for glass door panels less than 16 square feet in area.
2. KVP-992 roll-easy for glass door panels 16 square feet or larger in area.

L. Glass Shelf Supports: KV 256-R or LD-KV348.

M. Sliding Glass Door Pull: KV 831 or Melpa 70.1.

N. Counter Top Hinge: Soss, 204.

O. Paper Slots: 12 inches long by 1-3/4 inches wide by 1 inch deep; black, molded-plastic, paper-slot liner with 1/4-inch lip.

1. Manufacturer/Product: Doug Mockett & Company, Inc.; "Model CP-2."

P. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.

1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
2. Satin Stainless Steel: ANSI/BHMA 630.

Q. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.7 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed

anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Adhesives containing no urea formaldehyde and as recommended by fabricator or manufacturer. Use clear types where glue lines will be exposed.

D. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Structural Wood Member Adhesive: 140 g/L.
4. Architectural Sealants: 250 g/L.

2.8 FABRICATION

A. Interior Woodwork Grade: Comply with Woodwork Institute's (WI) "North American Architectural Woodwork Standards" (NAAWS), latest edition, quality standards indicated.

B. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

1. Accessible Casework: Comply with accessible regulatory requirements indicated in Part 2 Article "Performance Requirements."

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

E. Adjustable Shelf Standards: Adjustable shelf standards shall be recessed into cabinet sides.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION OF CABINETS

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to walls as indicated on Drawings and in compliance with referenced seismic requirements.

F. Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

3.3 INSTALLATION OF COUNTER TOPS

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Where applied back splashes are used, secure backsplashes to tops with concealed metal brackets at 16 inches on center and to walls with adhesive.
3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces.

END OF SECTION

SECTION 064600
ARCHITECTURAL WOOD TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior standing and running trim for opaque finish.
2. Shop priming of wood trim.

B. Related Requirements:

1. Division 06 Section "Rough Carpentry" for wood furring, blocking, and shims required for installing wood trim and concealed within other construction before wood trim installation.
2. Division 09 Section “Painting” for field finishing of exposed wood trim.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Field Finishing: Lumber for transparent finish, not less than three 24 inches long samples for each species and cut (Samples to be finished by painting subcontractor).

D. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop shall be familiar with Woodwork Institute (WI) material, fabrication, and installation requirements, and shall be capable of obtaining WI Certification labeling of shop drawings, fabricated products, and installation.

B. Installer Qualifications: Installer shall be fabricator of woodwork or fabricator shall be responsible for the Work of the installer. Installers shall be skilled workers who are experienced installing products similar to those required for this Project, who are familiar with Woodwork Institute fabrication requirements, and have a record of successful in-service performance.

C. Woodwork Institute (WI) Quality Assurance Program: Plastic Laminate Casework shall be subject to the following WI quality assurance program:

1. Certified Compliance Program (CCP):

a. A WI Certified Compliance Label shall be affixed to the first page of the original shop drawing set.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver wood trim until operations that could damage wood trim have been completed in installation areas. If wood trim must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with Woodwork Institute's (WI) "North American Architectural Woodwork Standards" (NAAWS), latest edition, for grades of architectural plastic-laminate cabinets and counter tops indicated for construction, finishes, installation, and other requirements.

1. Where indicated, provide labels and certificates from WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
2. Where the Contract Documents contain requirements in addition to or more restrictive than those of the quality standard indicated, comply with additional requirements indicated.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Grade: Custom.

B. Lumber Trim for Opaque Finish (Painted Finish):

1. Wood Species: Any closed-grain hardwood.

2. Maximum Moisture Content: 15 percent.
3. Finger Jointing: Not allowed.
4. Face Surface: Surfaced (smooth).

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

B. Lumber: DOC PS 20 and the following grading rules:

1. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
2. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

2.4 MISCELLANEOUS MATERIALS

A. Interior Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Adhesives: Do not use adhesives that contain urea formaldehyde.

E. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Structural Wood Member Adhesive: 140 g/L.
4. Architectural Sealants: 250 g/L.

2.5 FABRICATION

A. Fabricate wood trim to dimensions, profiles, and details indicated.

B. Ease edges as follows:

1. Solid-Wood Members 3/4 inch and Less in Thickness: 1/16 inch radius.
2. Solid Wood Members More Than 3/4 Inch Thick: 1/8 inch.

C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

2.6 SHOP PRIMING

A. General, Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.

B. Interior Wood Trim for Opaque Finish: Shop prime all sides with one coat of wood primer as specified in Division 09 Section "Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installation, condition materials to average prevailing humidity conditions in installation areas for a minimum of 72 hours unless longer conditioning is recommended by manufacturer.

C. Before installing architectural wood trim, examine shop-fabricated work for completion and complete work as required, including backpriming.

3.3 INSTALLATION

A. Grade: Install wood trim to comply with same grade as item to be installed.

B. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1. For shop-finished items, use filler matching finish of items being installed.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 72 inches long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.

B. Upon completion of installation, all portions of exposed work shall have handling marks or effects of exposure to moisture removed with a thorough fine sanding using at least 150 grit sandpaper or finer, and shall be cleaned before sealing or finish operations.

C. Clean wood trim on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 066400
FIBERGLASS REINFORCED PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

B. Related Sections:

1. Division 09 Section “Gypsum Board.”
2. Division 09 Section "Resinous Flooring” for resinous coved base installed below FRP bottom trim.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated; include installation instructions; product data for panels, trim, and adhesive; and VOC content and chemical components for adhesives and sealants.

B. Samples for Initial Selection: For plastic paneling and trim accessories.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 FIBERGLASS REINFORCED PLASTIC (FRP) SHEET PANELING

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. Fiberglass Reinforced Plastic Panels: Plastic panels complying with ASTM D 3841 comprised of thermosetting styrenated and acrylated polyester resins reinforced with glass fibers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Kemlite Company Inc.
    b. Marlite.
    c. Nudo Products, Inc.

2. Nominal Thickness: Not less than 0.09 inch.
3. Surface Finish: Molded pebble texture or smooth tile pattern as selected by Architect.

4. Color: As selected by Architect from manufacturer's full range of not less than six colors.
5. Surface-Burning Characteristics: Class A as determined according to ASTM E 84 by UL or another acceptable qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

2.2 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

B. Adhesive: As recommended by plastic paneling manufacturer.

1. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants."

1. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove wall coverings, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

D. Condition panels and trim by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

1. Mark plumb lines on substrate at trim accessory or panel joint locations for accurate installation.
2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels at locations indicated with vertical edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

1. Install panels vertically without horizontal joints unless distance is greater than the maximum available panel length. Where horizontal joints cannot be avoided, provide H-shaped trim between panels.

C. Install panels in a full spread of adhesive.

D. Install trim accessories with adhesive and nails; do not fasten through panels.

E. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

G. Remove excess sealant and smears as panels are installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.4 CLEANING

A. Clean panel faces to remove soiling, stains, dust, and dirt using clean rags and cleaning agents as instructed by panel manufacturer.

END OF SECTION

SECTION 071326
SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Self-adhering sheet waterproofing at below grade building, elevator pit and planter concrete walls.
2. Protection course.

B. Related Sections include the following:

1. Division 07 Section “Under Slab Vapor Barrier.”
2. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.
3. Division 31 Section “Earthwork” for backfilling.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

B. Source Limitations: Obtain waterproofing materials and protection course through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, and protection and repairs.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 SELF ADHERING SHEET WATERPROOFING

A. Modified Bituminous Sheet: Self-adhering sheet consisting of rubberized asphalt laminated on one side to a polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Basis of Design Products: Drawings and specifications are based on the following:

a. Meadows, W. R., Inc.; SealTight Mel-Rol.

1) Subject to compliance with requirements, provide the product specified or a comparable product by one of the following:

a) Carlisle Coatings & Waterproofing Inc.
b) Grace, W. R. & Co.

2. Physical Properties:

a. Thickness: 60 mill overall thickness; 56 mil rubberized asphalt sheet, 4 mil polyethylene film reinforcement.
b. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
c. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
d. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
e. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
g. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
h. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
i. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.

2.2 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.

F. Sheet Strips: Self-adhering sheet strips of same material and thickness as sheet waterproofing.

G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

I. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners, 1/8 inch nominal thickness.

1. Basis of Design Product: Drawings and specifications are based on the following:

a. Meadows, W. R., Inc.; Protection Course PC-2, Standard Duty.

J. Protection Course Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

F. Bridge and cover construction and contraction joints and cracks exceeding a width of 1/16 inch with overlapping sheet strips.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET WATERPROOFING APPLICATION

A. Install waterproofing sheets according to manufacturer's written instructions and according to recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

E. Seal edges of sheet-waterproofing terminations with mastic.

F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

G. Immediately install protection course with butted joints over waterproofing membrane.

1. If necessary, temporarily hold protection course in place using recommended adhesive by membrane manufacturer.
2. Backfill immediately using care and caution to avoid damage to waterproofing system.
3. Do not drop backfill material against protection course in such a manner that it could drag the sheet down as backfill drops.

3.4 PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 072114
THERMAL FOAM-PLASTIC BOARD WALL
AND UNDER-SLAB INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Extruded polystyrene (XPS) foam-plastic board insulation for use as a continuous insulation barrier over metal stud framed exterior walls.
2. Extruded polystyrene foam-plastic board insulation for use as under slab insulation for walk-in coolers and freezers.

B. Related Sections:

1. Division 03 Section “Concrete” for recessed slabs and topping over rigid insulation board at walk-in coolers and freezers.
2. Division 05 Section “Cold Formed Metal Framing” for exterior wall framing and Z-girts and J-moldings used in conjunction with insulation board at wall finish cladding.
3. Division 06 Section “Exterior Gypsum Sheathing” for sheathing installed over studs as a substrate for insulation board.
4. Division 07 Section “Weather Resistive Barriers” for weather resistive barriers installed as part of the exterior wall system.
5. Division 07 Section “Underslab Vapor Retarder” for underslab vapor retarders.
6. Division 09 Section “Portland Cement Plastering” for cement plaster finish systems applied over board insulation.
7. Division 11 Section "Walk-In Coolers and Freezers” for insulated concrete slabs.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (XPS)

A. Manufacturers: Subject to compliance with requirements, manufacturers providing products that may be incorporated into the Work include, but are not limited to:

1. DiversiFoam Products.
2. Dow Chemical Co.
3. Owens Corning.

B. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:

1. Type/Compressive Strength: ASTM C578, Type IV, 25-psi minimum.
2. Panel Thickness:

    a. Exterior Walls and Below Cooler Slab: 2-inches.
    b. Below Freezer Slab: 4-inches.

3. Panel Size: 2 ft. and/or 4 ft. wide by 8 ft. long typical.
4. Thermal Resistance: ASTM A 518, R-5.0 per inch of thickness, with 90% lifetime limited warranty on thermal resistance. (180 day real-time aging as mandated by ASTM C578, measured per ASTM C 518 at mean temperature of 75F).
5. Blowing Agent Formulation: Zero ozone depleting.
6. Edge Condition: Square or shiplap.
7. Panel Surface: Flat.
8. Surface Burning Characteristics, ASTM E 84 or UL 723: Flame spread less than 25, smoke developed less than 450, certified by independent third party such as Underwriters Laboratories (UL).
9. Indoor Air Quality: Compliance certified by independent third party such as GREENGUARD Indoor Air Quality Certified® and/or GREENGUARD Children and Schools Certified℠.

2.2 ACCESSORY MATERIALS

A. General: Insulation accessories recommended by insulation manufacturer for intended use and compatibility with other system components.

B. Insulation for Miscellaneous Voids: Spray polyurethane foam insulation, ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

C. Joint Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

D. Fasteners: Fasteners as recommended in writing by insulation manufacturer consisting of factory-coated steel fasteners and metal or plastic plates designed for fastening insulation boards to substrate, capable of pulling fastener head below surface of insulation board, and complying with the following:

1. For attachment to steel studs from 0.033 to 0.112 inch in thickness, provide steel drill screws complying with ASTM C954.

2. For attachment to light-gage steel framing members not less than 0.0179 inch in thickness, provide steel drill screws complying with ASTM C1002.

E. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach insulation to substrate or to another insulation layer.

1. Adhesive shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions with Installer present for conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.4 INSTALLATION OF WALL INSULATION

A. Coordinate installation of insulation with installation of substrate materials and materials installed over insulation so insulation is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

B. Wall Installation: Mechanically fasten insulation board to framing members as indicated on Drawings and as follows:

1. Apply insulation over dry substrates in courses, with long edges of boards oriented horizontally.
2. Begin first course of insulation from a level base line and work upward.
3. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings. Offset joints of insulation from horizontal joints in sheathing.
4. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.

5. Install fastener heads flush with plane of insulation. Install fasteners through steel stud framing members with not less than 5/16 inch penetration through metal wall framing.
6. Apply joint tape to joints between insulation boards and at items penetrating insulation boards. Apply at flashing to overlap both flashing and insulation boards.

3.5 INSTALLATION OF UNDER SLAB INSULATION

A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

B. Secure insulation boards in place with adhesive over the recessed concrete base slab as indicated on drawings. Carefully pour topping slab over insulation board to stay in position, as indicated on drawings.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, moisture, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 072116

BLANKET INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Glass fiber batt/blanket insulation for thermal and acoustical insulation installed in framing cavities.

B. Related Sections:

1. Division 07 Section “Thermal Foam-Plastic Board Wall and under-slab Insulation” for board insulation for walls.
2. Division 07 Sections as applicable to roofing for board insulation installed as part of a roofing system.
3. Division 23 Sections as applicable to air distribution duct systems for insulation for ducts.

1.3 SUBMITTALS

A. Product Data: For each type of insulation and accessory.

B. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. Sign, date, and post the certification in a conspicuous location on Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.
2. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Guardian Fiberglass, Inc.
3. Johns Manville.
4. Knauf Fiber Glass.
5. Owens-Corning.

C. Glass-Fiber Blanket Insulation, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

D. Glass-Fiber Blanket Insulation, Reinforced-Foil-Faced: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, or foil-scrim polyethylene vapor-retarder membrane on 1 face.

E. Thermal Resistance Values and Thicknesses: Where Drawings indicate thermal resistance values, provide units of the following nominal equivalent thicknesses:

1. R-13; 3-1/2 inch thickness.
2. R-19; 6 inch thickness.
3. R-25; 8 inch thickness.
4. R-30; 10 inch thickness.
5. R-38; 12 inch thickness.

2.2 ACCESSORY MATERIALS

A. Accessory materials shall be as recommended in writing by insulation manufacturer.

B. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.

2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.3 INSTALLATION

A. Install insulation in cavities formed by framing members in compliance with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation to provide a complete thermal envelope between the interior and exterior of the building and between conditioned and unconditioned interior spaces.

1. Provide insulation having thermal resistance values indicated on drawings, but not less than the following:

a. Walls: R-19.
b. Rafter Spaces and Ceilings: R-30.

2. Seal joints and fill gaps and voids in insulation using the following materials:

a. Spray Polyurethane Insulation: Seal joints and fill gaps, voids, and spaces around door and window frames with spray polyurethane insulation; apply according to manufacturer's written instructions.
b. Glass-Fiber Insulation: Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where it is not feasible to use spray polyurethane insulation; compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

C. Install insulation types according to the following:

1. Vapor-Retarder-Faced Blankets: Install vapor-retarder faced insulation at locations indicated below; install with vapor-retarder membrane to the climate conditioned side of framing.

a. Exterior Walls: Install vapor retarder faced insulation in stud wall cavities of exterior walls.
b. Interior Walls: Install vapor retarder faced insulation in stud wall cavities of interior walls between conditioned and unconditioned spaces.
c. Rafters: Install vapor retarder faced insulation in framing cavities between rafters.

2. Unfaced Blankets: Install in the following locations:

a. Interior Walls: Stud wall cavities of interior walls between conditioned interior spaces for acoustical insulation at locations indicated on the Drawings, thickness of insulation to match stud width.
b. Ceilings:

1) Thermal Applications: Install unfaced insulation over gypsum board ceilings having an unconditioned vented attic space above.
2) Acoustical Applications: Install unfaced insulation over ceilings at locations indicated on Drawings.

D. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

E. Install vapor barrier faced thermal insulation with manufacturer's R-value label exposed after insulation is installed.

F. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

G. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

H. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

I. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

J. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

K. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

L. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

M. Vapor Retarder Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

N. Water-Piping in Walls: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

O. Use mechanical anchorage to provide permanent placement and support of units.

3.4 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, moisture, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 072500
WEATHER RESISTIVE BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wrap.
2. Flexible flashing.

B. Related Sections include but are not limited to the following:

1. Division 06 Section “Exterior Gypsum Sheathing” for exterior gypsum sheathing.
2. Division 07 Section “Sheet Metal Flashing and Trim” for metal flashing and trim.
3. Division 08 Sections as applicable to doors, windows, and similar wall openings.
4. Division 09 Section “Portland Cement Plastering.”

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include data on air and moisture infiltration protection based on testing according to referenced standards.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Building wrap membrane.

C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing weather resistive barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain each type of product through one source from a single manufacturer.

C. Mockups: Before beginning installation, build mockup of weather resistive barrier assembly as directed by Architect, incorporate surface preparation, crack and joint treatment, sealing of gaps and terminations, and penetration flashing for window and door frames.

1. Approved mockups may become part of the completed Work if undisturbed and undamaged.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in their original undamaged packages in a clean, dry, protected location and in accordance with manufacturer's written recommendations.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Install weather resistive barrier materials within the range of ambient and substrate temperatures recommended by manufacturer. Protect substrates from environmental conditions that affect performance of weather resistive barrier system. Do not apply weather resistive barrier materials to damp or wet substrates or during snow, rain, fog, or mist.

1.7 COORDINATION

A. Coordinate the sequence of installation of weather resistive barrier materials with the installation of exterior wall sheathing and wall finish materials in order to minimize the exposure of sheathing and weather resistive barrier materials to moisture, wind, and sunlight.

PART 2 - PRODUCTS

2.1 BUILDING WRAP

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.

2. Performance Characteristics of Building Wrap:

a. Air Penetration: 0.001 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ≤0.04 cfm/ft^2 at 75 Pa, when tested in accordance with ASTM E2357.

b. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
c. Water Penetration Resistance: Minimum 280 cm when tested in accordance with AATCC Test Method 127.
d. Basis Weight: Minimum 2.7 oz/yd^2, when tested in accordance with TAPPI Test Method T-410.
e. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
f. Tensile Strength: Minimum 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
g. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
h. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 10, Smoke Developed: 10.
i. Allowable UV Exposure Time: Not less than three months.

2.2 SELF-ADHERING FLEXIBLE MEMBRANE FLASHING

A. Flexible Flashing: Composite, self-adhering, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film and removable protective membrane.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. DuPont (E. I. du Pont de Nemours and Company).

1) DuPont Flex-Wrap (70 mil), use at door and window heads and sills.
2) DuPont Straight-Flash (30 mil), use at door and window jambs.

2.3 SEALING TAPE AND FASTENERS

A. Sealing Tape: Pressure-sensitive plastic tape recommended by building wrap manufacturer for sealing joints and penetrations in building wrap, 4 inch minimum width tape.

B. Screws for Fastening Membrane to Steel Framing: Manufacturer’s standard corrosion resistant screws with 2-inch diameter plastic washers and of length required to penetrate not less than 1-inch into framing.

2.4 MISCELLANEOUS MATERIALS

A. Primers: Primers as recommended in writing by weather resistive barrier material manufacturer.

B. Sealants: Sealants as recommended in writing by weather resistive barrier material manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Installer present for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for weather resistive barrier material application.

B. Treat fins, ridges, other projections, and changes in substrate plane to provide a smooth transition and eliminate sharp projections or edges between surfaces.

3.3 INSTALLATION, GENERAL

A. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

B. Coordinate installation of building wrap with installation of flexible flashing.

C. Coordinate installation of weather resistive barrier materials with installation of wall sheathing and subsequent application/installation of exterior wall finish materials.

3.4 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing at exterior door, window, and similar openings, and at wall penetrations and other flashing conditions to comply with manufacturer’s written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
3. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

B. Begin installation of flexible flashing at sills of openings, lap jamb flashing over sill flashing, lap head flashing over jamb flashing.

1. Fasten sill flashing at top edge only to allow for subsequent installation of building wrap membrane behind sill flashing.

3.5 BUILDING WRAP MEMBRANE INSTALLATION

A. General: Install building wrap over exterior side of wall sheathing in accordance with manufacturer's written instructions and as follows.

1. Begin installation of the building wrap at the bottom of the wall, run building wrap horizontally and set level. Install subsequent layers over previous layers lapping horizontal joints not less than 2 inches in shingle fashion for drainage.
2. Overlap building wrap at corners of building by a minimum of 12 inches.
3. Overlap building wrap at vertical seams by a minimum of 6 inches.
4. Seal seams, edges, fasteners, tears, and penetrations with tape.
5. Install building wrap behind flexible sill flashing lapped in shingle fashion to shed water.
6. Extend over jambs of openings and seal corners with tape.
7. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion or control-joint locations.
8. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.
9. Secure building wrap If not self-adhering) with screws with washers screwed through exterior sheathing and into stud framing. Provide and space fasteners as recommended in writing by building wrap manufacturer.

3.6 PROTECTION

A. Protect weather resistive barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions, until subsequent finishes are applied.

1. Protect weather resistive barrier materials from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace weather resistive barrier materials exposed to these conditions for more than 30 days.

END OF SECTION

SECTION 072616

UNDERSLAB VAPOR RETARDER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Under slab vapor retarder for concrete slabs on grade.

B. Related Sections include but are not limited to the following:

1. Division 01 Section “Photographic Documentation.”
2. Division 03 Section "Cast-in-Place Concrete."
3. Division 31 Section "Earthwork."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include manufacturer’s specifications and installation instructions.

B. Testing Documentation: Third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1.

C. Samples: For vapor retarder membrane.

D. Digital Photography: Digital photographs of completed installation including seam and penetration sealing, terminations at foundations, and repairs.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor retarder.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Review procedures for field quality control, vapor-barrier installation, steel reinforcement installation, repair procedures, and protection.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened packaging, with labels identifying manufacturer and product.

B. Store materials in accordance with manufacturer's written instructions and to prevent damage.

C. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

A. Do not apply material during rain or during windy conditions.

B. Do not apply on frozen ground.

1.7 COORDINATION

A. Coordinate installation of vapor retarder, reinforcing steel, and placement of concrete to minimize tears and punctures, and to minimize exposure of vapor retarder to sunlight.

PART 2 - PRODUCTS

2.1 VAPOR RETARDERS

A. Plastic Vapor Retarder: Single ply membrane extruded from virgin grade high-impact polyolefin complying with ASTM E 1745, Class A.

1. Available Products: Subject to compliance with requirements, provide one of the following products:

    a. Raven Industries Inc.; Vapor Block 15.
    b. Stego Industries, LLC; Stego Wrap 15 mil.
    c. W.R. Meadows, Inc., Perminator 15.

2. Thickness: 15 mils.
3. Roll Width: 12 feet minimum.
4. Maximum Permeance: One of the following: ASTM E1745 Section 7.1 (7.1.1-7.1.5), permeance of less than 0.01 Perms (grains/(ft^2 · hr · inHg)) after conditioning.

5. Puncture Resistance: ASTM D1709, Method B, not less than 2,266 Grams.

2.2 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by manufacturer for intended use and compatible with vapor retarder.

B. Seam Tape: High Density Polyethylene Tape with pressure sensitive adhesive as manufactured or recommended by vapor retarder manufacturer, minimum width 4 inches.

C. Pipe Boots: Construct pipe boots from vapor retarder material and pressure sensitive tape per manufacturer’s written installation instructions.

D. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions with Installer present for compliance with requirements for conditions affecting performance of the Work.

B. Proceed with installation of vapor retarder only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Level and tamp or roll granular base as specified in Division 31 Section “Earthwork.”

3.3 INSTALLATION OF VAPOR RETARDER

A. Vapor Retarders: Place, protect, and repair vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Vapor retarder to be installed over prepared, finely graded subgrade.

B. Unroll vapor retarder and install with the longest dimension parallel with the direction of the pour. Open all folds to the full width.

C. Lap joints 6 inches and seal with manufacturer's recommended tape.

D. Seal holes, openings, and pipe and conduit penetrations in vapor retarder. Fabricate boots around pipes and conduits in accordance with manufacturer’s written installation instructions and seal with tape.

E. Areas of adhesion for taped seams, penetrations, and repairs shall be free of dust, dirt, moisture, or other conditions affecting the performance of the tape seal.

F. Terminate vapor retarder at vertical foundation walls by turning up 4 inches against the wall and sealing with tape or fastening with concrete nails spaced 4 feet on center. Where vertical foundation walls do not occur, extend vapor retarder not less than 12 inches into footing trench prior to pouring footings.

G. Coordinate installation of vapor retarder with Work Division 3 Section “Cast-in-Place Concrete.”

1. Use only brick type reinforcing bar supports for reinforcing steel.
2. Avoid driving stakes through vapor retarder membrane, repair all holes.
3. Provide for protection of vapor retarder membrane in high traffic areas.

3.4 FIELD QUALITY CONTROL

A. Immediately after the installation of the vapor retarder, the Contractor, in the presence of the Owner’s Inspector or representative, shall review the completed installation and document the installation using digital photography. Documentation shall include the completed installation, seams, penetrations, terminations, and repairs.

B. After installation of reinforcing steel and just prior to pouring of concrete, the Contractor, in the presence of the Owner’s Inspector or representative, shall review the installed vapor retarder for tears or damage.

C. Inspection reports shall be submitted to the Architect and the Contractor.

3.5 REPAIRS

A. Repair tears and punctures with a vapor retarder patch that overlaps the damaged area by 6 inches in all directions, seal perimeter of the patch with tape.

3.6 PROTECTION

A. Protect installed vapor retarders from damage due to UV light, harmful weather exposures, physical abuse, and other causes until concealed by permanent construction.

B. Remove rain or water from retarder prior to concrete placement by air blowers.

END OF SECTION

SECTION 074213

FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior metal wall panels as follows:

a. Exposed fastener, lap seam metal wall panels including associated trim and flashings.
b. Concealed fastener lap seam metal wall panels including associated trim and flashings.
c. Associated trim for metal wall panels.

B. Related Sections:

1. Division 07 Section "Sheet Metal Flashing and Trim" for additional requirements for sheet metal flashing and trim.
2. Division 07 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory and field-assembled work.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar samples of trim and accessories involving color selection.

D. Product Test Reports: Research/Evaluation Reports from ICC-ES or IAPMO for metal panels.

E. Qualification Data: For Installer.

F. Field quality-control reports.

G. Warranties: Samples of special warranties.

H. Maintenance Data: For metal panels to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by panel manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.6 COORDINATION

A. Coordinate metal panel installation with trim and other adjoining work.

1.7 WARRANTY

A. Special Warranty, Materials and Workmanship, and Finishes: A single warranty, or warranty from a single entity, shall be provided for steel substrate material, Zincalume base, and factory finishing. Warranties shall apply to, but not be limited to, panels, flashing, and trim.

1. Special Warranty, Material and Workmanship: Manufacturer's standard form in which manufacturer agrees to repair or replace metal panel systems that fail in materials or workmanship within specified warranty period.

a. Failures include, but are not limited to, the following:

1) Structural failures including rupturing, cracking, or puncturing.

2) Deterioration of metals, metal finishes, and other materials beyond normal weathering.

b. Warranty Period: 2 years from date of Substantial Completion.

2. Special Warranty, Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period. Warranty shall include finishes for exposed fasteners.

a. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

1) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.

b. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Basis of Design Manufacturer: Where Basis of Design named manufacturer metal wall panel designations are indicated in this Section, metal panels are based on products by the following:

1. Metal Sales.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) AEP Span, a Division of ASC Profiles, Inc.
2) CENTRIA Architectural Systems.
3) MBCI, a division of NCI Building Systems.

4) McElroy Metal, Inc.
5) Morin Corporation.
6) Taylor Metal Products.

2.3 PANELS WP-1/MP-1 AND WP-2/MP-2, CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Factory-formed metal wall panels designed to be field assembled by installing horizontally or vertically and lapping interlocking edges of adjacent panels and mechanically attaching panels to supports using concealed fasteners and factory applied sealant.

1. Basis-of-Design Product: Metal Sales; TLC-1.
2. Panel Characteristics:

a. Profile: Flush.

1) Panel Coverage: 12 inches nominal.
2) Panel Height: 1-1/2 inches.

b. Material: Metallic-coated steel sheet, aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Painted material) or AZ55 (Unpainted material) coating designation; structural quality, Grade 50.

1) Nominal Thickness: 0.0236 inch (24 gauge).
2) Surface: Smooth.

c. Finish:

1) Exposed Finish:

a) Panel WP-1/MP-1: Acrylic coated Galvalume.
b) Panel WP-2/MP-2: Two-coat fluoropolymer, custom color as indicated on drawings as approved by Architect.

2) Concealed Finish:

a) Panel WP-1/MP-1: Acrylic coated Galvalume.
b) Panel WP-2/MP-2: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.4 PANEL WP-3/MP-3, EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Factory-formed corrugated metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners.

1. Basis-of-Design Product: Metal Sales; 7/8” Corrugated.
2. Panel Characteristics:

a. Profile: Corrugated.

1) Panel Coverage: 32 to 36 inches nominal.
2) Panel Height: 7/8 inches.
3) Rib Spacing: 2-2/3 inches on center.

b. Material: Metallic-coated steel sheet, aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Painted material) or AZ55 (Unpainted material) coating designation; structural quality, Grade 50.

1) Nominal Thickness: 0.0236 inch (24 gauge).
2) Surface: Smooth.

c. Finish: Acrylic coated Galvalume.

2.5 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Trim: Provide trim for a complete panel system including trim. Fabricate trim from same material, thickness and finish as panels.

C. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Provide exposed fasteners by panel manufacturer with heads finished to match color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.6 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. End Seams for Coil Coated Finished Material: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. End Seams for Field Finished Material: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal panel manufacturer for application, but not less than thickness of metal being secured.

2.7 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Exposed Surfaces: Two-coat fluoropolymer AAMA 621 finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

B. Examine wall framing to verify that girts, angles, channels, studs, and other panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

C. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking, and that installation is within flatness tolerances required by metal wall panel manufacturer.

D. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Install screw fasteners in predrilled holes.

3. Locate and space exposed fastenings in uniform vertical and horizontal alignment.
4. Install trim as metal panel work proceeds.
5. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
6. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

C. Exposed Fastener Lap-Seam Metal Wall Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap sheets not less than one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on exposed side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Trim panels at perimeter of all edges and openings.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof,

form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 075419
POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Adhered polyvinyl-chloride (PVC) roofing system.
2. Substrate board.
3. Roof insulation including tapered insulation.
4. Cover board.
5. Walkways

B. Related Sections:

1. Division 05 Section “Steel Decking” for metal decking supporting the roof system.
2. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof flashings and counter flashings.
4. Division 07 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Division 22 Sections as applicable to plumbing fixtures for roof and overflow drains.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated and to be incorporated into the Work; include the following:

1. Product Data for Solar Reflectance and Emissivity: For roof materials, indicating that roof materials comply with the current requirements of California Title 24, Part 6.

2. Product Data for VOC Content: For adhesives and sealants, including printed statement of VOC content.
3. Laboratory Test Reports: For adhesives and sealants used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Qualification Data: For qualified Installer.

D. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

F. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

G. Field quality-control reports.

H. Maintenance Data: For roofing system to include in maintenance manuals.

I. Sample Warranties: For manufacturer's special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's technical

representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of membrane roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 10,000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7 and local building codes.

D. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a built-up roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-90.

E. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

F. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

G. Exterior Fire-Test Exposure: Roofing system shall meet the current requirements of CA Title 24, Part 6 and UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation, fasteners, and accessory materials for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

B. Manufacturer, Basis of Design: In other “Part 2 – Products” Articles where named manufacturer products are indicated by “Basis of Design,” Drawings and Specifications are based on products indicated. Provide products indicated, or subject to compliance with requirements indicated, provide comparable products subject to Request for Substitution.

1. Basis of Design Manufacturer: Sika Corporation; Sarnafil.

    a. Subject to compliance with requirements, provide products by specified manufacturer or comparable products by one of the following subject to request for substitution:

        1) Johns Manville
        2) GAF Materials Corporation.
        3) Duro Last Roofing, Inc.

2.3 POLYVINYL-CHLORIDE (PVC) ROOF MEMBRANE

A. PVC Sheet: ASTM D D 4434, Type II, Grade 1, Thermoplastic PVC membrane with polyester reinforcement, felt backing, and lacquer coating.

1. Basis of Design: Sika Sarnafil; G410-80 Feltback EnergySmart PVC membrane.
2. Thickness: 80 mils nominal.
3. Exposed Face Color: White.

2.4 FLASHING MATERIALS

A. Flashing Material: Roofing membrane manufacturer's sheet and/or strip membrane flashing of same material, type, reinforcement, 60 mil. thickness, and color as membrane roofing sheet, with or without fabric backing, as recommended by roof system manufacturer.

B. Metal Flashing: Roofing membrane manufacturer's PVC coated, heat weldable metal flashing, ASTM A 653 G90 coating, 24 gauge, with 20 mil PVC membrane factory applied to one side.

1. Basis of Design: Sika Sarnafil; Sarnaclad PVC coated metal flashing sheet.

C. Miscellaneous Flashings: As recommended in writing by membrane manufacturer for detail and warranty conditions indicated.

2.5 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary roofing materials recommended in writing by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesive: 80 g/L.
f. Other Adhesives: 250 g/L.
g. Single-Ply Roof Membrane Sealants: 450 g/L.
h. Nonmembrane Roof Sealants: 300 g/L.
i. Sealant Primers for Nonporous Substrates: 250 g/L.
j. Sealant Primers for Porous Substrates: 775 g/L.

B. Adhesive: Manufacturer's standard complying with VOC limits of authorities having jurisdiction.

C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick.

D. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

E. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

F. Sealant: As recommended in writing by membrane manufacturer for conditions indicated complying with VOC limits of authorities having jurisdiction.

2.6 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant Type X gypsum substrate, 5/8 inch thick.

1. Basis of Design: Georgia Pacific; Dens Deck.

2.7 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, inorganic coated glass-fiber mat facer on both major surfaces.

1. Provide two layers of 2.6 inch polyisocyanurate insulation to achieve an R30 insulation value.

C. Tapered Insulation: Factory-tapered insulation boards matching roof insulation and having slope indicated on Drawings.

1. Finished roof slope at tapered insulation areas shall be not less than 1/4 inch per 12 inches.

D. Crickets, and Saddles: Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick.

1. Basis of Design: Georgia-Pacific Corporation; Dens Deck Prime.

2.9 WALKWAYS

A. Flexible Walkways: Roof membrane manufacturer’s reinforced thermoplastic nonporous, surface-textured walkway pads or rolls, 90 mil nominal thickness and 39 inch nominal width.

1. Basis of Design: Sika Sarnafil Sarnatred-V.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Stainless steel, corrosion resistant, fasteners are required when mechanically attaching any roofing products to wood nailers and wood products treated with ACQ (Alkaline copper Quaternary). A separation layer must be placed between metal and ACQ treated wood.

3.4 SUBSTRATE BOARD INSTALLATION

A. Install substrate boards with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 INSULATION INSTALLATION

A. Coordinate installation of roof system components so no more insulation board is installed than can be covered with roofing membrane by the end of the workday or the onset of inclement weather.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install continuous pressure treated wood nailers at the perimeter of the entire roof and around roof projections and penetrations as shown on the Drawings.

1. Thickness shall be as required to match height of substrate board and insulation to allow a smooth transition.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness exceeds 2.5 inches, install insulation in two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches in each direction.

E. Install base layer of insulation with end joints staggered not less than 12 inches in adjacent rows.

1. Trim insulation to fit neatly around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. Make joints between adjacent insulation boards not more than 1/4 inch in width.
3. At internal roof drains, slope insulation to create a drain sump with each side equal to the diameter of the drain bowl plus 24 inches, trim insulation so that water flow is unrestricted.
4. Fill gaps exceeding 1/4 inch with insulation.
5. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

F. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification to resist uplift pressure at corners, perimeter, and field of roof.
2. Adhere each subsequent layer of insulation to previous layer of insulation in compliance with roofing system manufacturer’s written installation instructions for adhered insulation.

G. Install tapered insulation under area of roofing to conform to slopes indicated.

3.6 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump, trim cover board so that water flow is unrestricted.
3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification or SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity, and FM Global Property Loss Prevention Data Sheet 1-29.

3.7 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Unroll roof membrane and allow to relax before installing.

B. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Apply roofing with side laps shingled with slope of roof deck where possible.

D. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

1. Spray or roller apply adhesive to the substrate in accordance with manufacturer’s instructions at rate required by manufacturer.
2. Place membrane into wet adhesive and immediately broom and roll with minimum 100 lb steel membrane roller.
3. Adhesive shall not be used if temperatures below 40°F are expected during application or subsequent drying time.

E. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

F. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of three times per day, and repair seam sample areas.
3. Verify field strength of seams by seam test cuts as follows:

    a. Perimeters and Corners: Test a minimum of three times per day, and repair seam sample areas.
    b. Field Areas: Test a minimum of two times per day, and repair seam sample areas.

4. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

G. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 BASE FLASHING INSTALLATION

A. General: Flashings shall be installed concurrently with the roof membrane as the Work progresses.

1. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and roofing membrane manufacturer’s technical representative. Approval shall only be for specific locations for specific dates.
2. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at no additional cost to the Owner.

B. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

1. Flashing shall be adhered to compatible, dry, smooth surfaces.
2. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

F. Metal Flashings:

1. Metal flashings shall be PVC Laminated metal.
2. Metal flashings shall be securely fastened into solid wood blocking. Fasteners shall penetrate the wood nailer a minimum of 1 inch. Stainless steel fasteners are required when mechanically attaching metal flashing to wood nailers and wood products treated with ACQ (Alkaline copper Quaternary). A separation layer must be placed between metal and ACQ treated wood.
3. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.

3.9 WALKWAY INSTALLATION

A. Walkways: Install walkway products in locations indicated, adhere walkway products to roof membrane substrate, except edges, and hot air weld edges.

3.10 FIELD QUALITY CONTROL

A. Inspection: Engage roofing system manufacturer's technical representative to be present at preinstallation meeting, to inspect substrate conditions, surface preparation, membrane application, flashings, protection, drainage components, and completed roof installation.

1. Testing shall be performed as directed by roofing system manufacturer’s technical representative.
2. Roof system manufacturer’s technical representative shall prepare inspection reports and submit reports to Architect.
3. Prior to demobilization from the site, the work shall be reviewed by the roofing system manufacturer's technical representative and the Installer. All Deficiencies shall be noted in the inspection report and shall be immediately corrected by the installer to the satisfaction of the roofing system manufacturer's technical representative.

B. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

D. Quality Control of Welded Seams: Installer shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark gray material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the installer at locations as directed by the manufacturer's technical representative. One inch wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no additional cost to the Owner.

3.11 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

(ROOFING INSTALLERS WARRANTY Article begins on the next page)

3.12 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner**>.
2. Address: <**Insert address**>.
3. Building Name/Type: <**Insert information**>.
4. Address: <**Insert address**>.
5. Area of Work: <**Insert information**>.
6. Acceptance Date: <**Insert date**>.
7. Warranty Period: <**Insert time**>.
8. Expiration Date: <**Insert date**>.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

a. Lightning;

b. Peak gust wind speed exceeding 60 mph;
c. Fire;
d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. Vapor condensation on bottom of roofing; and
g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manufactured Sheet Metal Flashing Products:

a. Manufactured reglets and counter flashing.

2. Formed sheet metal fabrications:

a. Flashing and trim.
b. Copings.
c. Miscellaneous sheet metal fabrications.

B. Related Sections include the following:

1. Division 06 Section “Miscellaneous Rough Carpentry” for wood nailers, grounds, curbs, and blocking.
2. Division 07 Sections as applicable to metal roof and wall panels for sheet metal flashing and trim integral with metal roof and wall panel systems.
3. Division 07 Sections as applicable to roofing for sheet metal flashing and trim integral with roofing systems.
4. Division 07 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For fabricated sheet metal items. Show fabrication and installation layouts including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish; submit 12 inch long sample of fabricated unit including finished seam, fasteners, cleats, clips, closures, and other attachments.

E. Qualification Data: For fabricator.

F. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested.

G. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Parapet copings & sloped glazing edge flashing.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim.
2. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
4. Review requirements for insurance and certificates if applicable.
5. Review sheet metal flashing observation and repair procedures after flashing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The Roofing and Waterproofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements as applicable for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Horizontal Outward Pressure: 24 psf.
2. Vertical Upward Pressure: 75 psf.

D. Thermal Movements: Sheet metal flashing and trim shall allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface as appropriate for project conditions, selected from the following:

1. As-Milled Finish: Mill finish.
2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: Smooth, flat.

2. Coil-Coated Finish:

   a. Exposed Coil-Coated Finish: Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

      1) Color: As selected by Architect from manufacturer's full range.

   b. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

D. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 4 (polished directional satin).

   a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

      1) Run grain of directional finishes with long dimension of each piece or as otherwise directed by Architect.
      2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil thick polyethylene sheet complying with ASTM D 4397.

B. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. Products: Subject to compliance with requirements, provide one of the following:

   a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
   b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
   c. Henry Company; Blueskin PE200 HT.

d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. Self-drilling screws, gasketed, with hex-washer head.
2. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. Solder for Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, polysulfide, or silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and welded corners and junctions.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Fry Reglet Corporation.
    b. Heckmann Building Products Inc.
    c. Hickman, W. P. Company.

2. Material: Galvanized steel, 0.0217 inch thick.

3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers and with channel for sealant at top edge.
4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
7. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
8. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim as indicated on Drawings and to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored and of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams and as follows:

1. Seams for Pre-Finished Metal: Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
2. Seams for Unfinished Sheet Steel: Tin edges to be seamed, form seams, and solder.
3. Seams for Unfinished Aluminum: Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

G. Do not use graphite pencils to mark metal surfaces.

H. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from 0.028 inch (24 gage) thick galvanized steel.

B. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from 0.034 inch (22 gage) thick galvanized steel.

C. Splash Pans: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing and Fascia Caps: Fabricate in minimum 96-inch long, but not exceeding 10 foot long, sections. Furnish with 6-inch wide joint cover plates. Fabricate from 0.028 inch (24 gage) thick galvanized steel.

1. Joint Style: Lap, 4 inches wide.

B. Copings: Fabricate to cross section indicated in minimum 96-inch long, but not exceeding 10 foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight. Fabricate from 0.028 inch (24 gage) thick galvanized steel.

1. Joint Style: Butt, with 12-inch wide, concealed backup plate and 6-inch wide, exposed cover plates

C. Counterflashing: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

D. Roof-Penetration Flashing: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

E. Roof-Drain Flashing: Fabricate from zinc-tin alloy-coated stainless steel, 0.015 inch thick.

2.9 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

B. Drip Edges: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

C. Eave, Rake Flashing: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

D. Base Flashing: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

E. Roof-Penetration Flashing: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

2.10 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch high end dams. Fabricate from 0.028 inch (24 gage) thick galvanized steel.

B. Wall Expansion-Joint Cover: Fabricate from 0.028 inch (24 gage) thick galvanized steel.

2.11 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Miscellaneous Sheet Metal Fabrications: Fabricate from 0.028 inch (24 gage) thick galvanized steel unless otherwise indicated.

2.12 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.

B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corners or intersections. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes:

1. Wood Framing, Blocking, and Sheathing: Use fasteners of sizes that will penetrate [wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
2. Metal Framing, Backing, and Decking: Use fasteners of sizes that will penetrate metal framing, backing, and decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70

deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder coil-coated steel and aluminum sheet.
2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

G. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.4 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement or elastomeric sealant compatible with roofing membrane.

C. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Seal or solder exterior wall scupper flanges into back of conductor head.

D. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below scupper discharge.

E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches (100 mm) in direction of water flow.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, SMACNA's "Architectural Sheet Metal Manual," and NRCA’s Roofing and Waterproofing Manuals as applicable to project conditions Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to referenced requirements and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with [**elastomeric**] [**butyl**] sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Reglets and Counterflashing: Install in accordance with manufacturer’s written installation instructions.

C. Openings Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings, unless shown otherwise on the drawings.

3.7 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 077233

ROOF HATCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof hatches.
2. Roof hatch guardrails.

B. Related Sections:

1. Division 05 Section "Metal Ladders" for vertical ladders for access to roof hatches and telescoping safety posts for ladders.
2. Division 07 Sections as applicable to roofing systems.

1.3 SUBMITTALS

A. Product Data: For roof hatch and guardrail system. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof hatches and guardrail system; include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions.

C. Operation and Maintenance Data: For roof hatch and guardrail system to include in operation and maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of roof hatches with roof framing, roofing system, flashing, and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS, GENERAL

A. General Performance: Roof hatches and guardrail systems shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated single-walled curbs with welded corners, continuous lid-to-curb counterflashing, weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Babcock-Davis.
    b. Bilco Company (The).
    c. Dur-Red Products.
    d. J. L. Industries, Inc.
    e. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
    f. Nystrom.

2. Type and Size: Single-leaf lid, 30 by 36 inches unless indicated otherwise on drawings.

3. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

4. Hatch Material: Zinc-coated (galvanized) steel sheet, 0.079 inch (14 gage) thick.

    a. Finish: Baked enamel or powder coat finish.
    b. Color: As selected by Architect from manufacturer's full range.

5. Construction:

    a. Curb Insulation: 1 inch thick cellulosic fiber board.
    b. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
    c. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
    d. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

6. Hardware: Spring operators, hold open arm, galvanized steel spring latch with turn handles, galvanized or stainless steel butt or pintle-type hinge system, and padlock hasps inside and outside.

2.3 ROOF HATCH SAFETY RAILING SYSTEM

A. Performance Requirements: Comply with 29 CFR 1910.23 requirements and authorities having jurisdiction including CAL-OSHA.

B. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; and attached to roof hatch.

1. Height: 42 inches minimum above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Maximum Opening Size between Rails: System constructed to prevent passage of a sphere 21 inches in diameter.
4. Gate: Self-closing and self-latching gate fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
5. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
6. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
7. Fabricate joints exposed to weather to be watertight.
8. Fasteners: Manufacturer's standard, finished to match railing system.
9. Finish: Manufacturer's standard.

2.4 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.

1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

C. Steel Tube: ASTM A 500, round tube.

D. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

E. Steel Pipe: ASTM A 53/A 53M, galvanized.

F. Aluminum Extrusion and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.

C. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.

D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Underlayment:

1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Polyethylene Sheet: 6-mil thick polyethylene sheet complying with ASTM D 4397.
3. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

G. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

I. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

J. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

K. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof hatches and accessories according to manufacturer's written instructions.

1. Install roof hatches and accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof hatches and accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation and fit them to substrates.
4. Install roof hatches and accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:

1. Install roof hatch so top surface of hatch curb is level.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

D. Safety Railing Installation: Attach safety railing system to roof-hatch curb.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean bolted connections and abraded areas, and repair galvanizing according to ASTM A 780.

B. Touch up factory-finished surfaces with compatible finish.

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace items that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 078413

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Penetration firestopping systems for the following applications:
    a. Penetrations in fire-resistance-rated walls, including perimeter edges.
    b. Penetrations in horizontal assemblies.
2. Identification of penetration firestopping.
3. Identification of fire separation walls.

B. Related Sections:

1. Division 09 Section “Gypsum Board” for top of wall framing conditions.
2. Division 21, 22, and 23 Sections as applicable to penetrations of fire rated construction by pipes and ducts for plumbing and mechanical work.
3. Division 26 through 28 Sections as applicable to penetrations of fire rated construction by conduit and wiring for electrical, communication, and electronic security work.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

C. Qualification Data: For qualified Installer.

D. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

E. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or has been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements;" and who employs installers experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

D. Do not cover up penetration firestopping system installations that will become concealed behind other construction until each installation has been labeled, examined by Owner's inspecting agency, and building inspector if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Penetration Firestopping Systems: Penetration firestopping systems shall resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Each penetration firestopping system shall be in accordance with firestopping systems tested and approved by one of the following:

1. UL in its "Fire Resistance Directory."
2. Intertek Group in its "Directory of Listed Building Products."
3. FM Approval in its "Approval Guide."

C. Penetration firestopping systems shall be identical to those tested per testing standard indicated.

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grace Construction Products.
2. Hilti, Inc.
3. 3M Fire Protection Products.

B. Wall Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Floor/Ceiling Penetrations in Fire-Resistance-Rated Horizontal Assemblies: Penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Exposed Penetration Firestopping: Products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. VOC Content of Firestopping Sealants: Provide penetration firestopping sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:

   a. Slag-wool-fiber or rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.

2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and

fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions, or any other wall required to have protected openings or penetrations, shall be permanently identified in accessible concealed floor, floor/ceiling, or attic spaces, with signs or stenciling as required by 2022 CBC Section 703.5. Identification shall:

1. Be located in accessible concealed floor, floor/ceiling, or attic spaces.
2. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet horizontal distance measured along the wall or partition.
3. Include lettering not less than 3 inches in height having a 3/8 inch minimum stroke width in a color contrasting with the wall, and incorporating the suggested wording “Fire and/or Smoke Barrier - Protect all Openings” or similar wording.

B. Identification of Penetration Firestopping: Identify penetration firestopping with preprinted metal or plastic labels at each surface penetrated. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels

will be visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Penetration Firestopping - Do Not Disturb."
2. Applicable firestopping system designation and testing and inspecting agency.
3. Manufacturer's name.
4. Date of installation.
5. Contractor's name, address, and phone number.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Testing and Inspecting Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to perform tests and inspections as applicable and prepare reports.

1. Testing and Inspection Agency shall be acceptable to the Architect and the Division of the State Architect.
2. Testing and inspecting agency will report test results promptly and in writing to Architect, Division of the State Architect, and Contractor.
3. The cost of additional testing and inspecting of corrected, replaced and/or additional Work will be paid for by the Owner and the cost will be deducted from the contract sum by a change order.

B. The Architect and the Division of the State Architect shall have the right to order the testing of any materials used in the steel construction to determine if they are of the quality specified.

C. Contractor Duties and Responsibilities:

1. Contractor shall maintain control of the quality of materials and workmanship to conform to the drawings and specifications.
2. Facilitate testing and inspection as follows:

    a. Schedule tests and inspections with the Testing and Inspection Agency sufficiently in advance of operations to allow for the assignment of personnel and for the completion of testing and inspecting responsibilities.
    b. Provide access to the Work for the designated Testing and Inspection Agency.
    c. Furnish all necessary materials and labor to assist the designated testing and inspecting agency in obtaining and handling samples at the project or other sources of materials.

3. Contractor shall correct deficiencies in the Work where tests and inspections indicate the Work does not comply with the Contract Documents.

D. Tests and Inspections: Testing of penetration firestopping stopping shall be conducted by an approved testing agency in accordance with ASTM E 2174.

E. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

F. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

A. Provide UL-classified systems indicated as referenced to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Concrete Floor/Ceiling/Roof Penetrations:

1. Metallic Pipes: FE 1001-1999.
2. Insulated Metal Pipes: FE 5001-5999.
3. Non-Metallic Pipes: FE 2001-2999.
4. Sheet Metal Ducts: FE 7001-7999.
5. Cable Trays: FE 3001-3999.

C. Concrete and Masonry Wall Penetrations:

1. Blank Opening: CAJ 0001-0999, FA 0001-0999, WJ 0001=0999.
2. Metallic Pipes: CAJ 1001-1999.
3. Insulated Metallic Pipes: CAJ 5001-5999.
4. Non-Metallic Pipes: CAJ 2001-2999, FA 2001-2999, WJ 2001-2999.
5. Sheet Metal Ducts: CAJ 7001-7999, WJ 7001-7999.
6. Miscellaneous Electrical Items: CAJ 6001-6999.
7. Cable Trays: CAJ 3001-3999, WJ 3001-3999.

D. Gypsum Board Wall Penetrations:

1. Blank Opening: WL 0001-0999.
2. Metallic Pipes: WL 1001-1999.
3. Insulated Metallic Pipes: WL 5001-5999.
4. Non-Metallic Pipes: WL 2001-2999.
5. Sheet Metal Ducts: WL 7001-7999.

6. Miscellaneous Electrical Items: WL 6001-6999.
7. Cable Trays: WL 3001-3999.

E. Gypsum Board Wall Terminations:

1. Top of Wall to Concrete/Metal Deck: HWD 0001-0999.

END OF SECTION

SECTION 079200

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants including mildew resistant silicone joint sealants
2. Urethane joint sealants.
3. Latex joint sealants.
4. Acoustical joint sealants.
5. Joint sealant Backings

B. Related Sections:

1. Division 07 Section "Penetration Firestopping" for sealing joints in fire-resistance-rated construction.
2. Division 32 Section “Concrete Paving Joint Sealants” for exterior concrete paving joint sealants.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product, include documentation for VOC content of sealants and sealant primers.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Field-Adhesion Test Reports: For each sealant application tested.

E. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity employing installers trained and experienced in installing joint sealants similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.

B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

C. Preinstallation Conference: Conduct conference at Project site.

1.5 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties shall warrant that all exposed sealants will be guaranteed against any crazing developing on the surfaces of the material, any staining of adjacent surfaces by sealant or by primer (yellowing, etc.), chalking, or color changes on surface of cured sealant.

D. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.

2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content: Sealants and primers applied at the Project site shall comply with VOC limits of authorities having jurisdiction; VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); and VOC limits of the California Green Building Standards Code (CGBSC), Section 5.504.4.1 and Table 504.4.2 as follows:

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are indicated to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are used in areas of food preparation, use products that comply with 21 CFR 177.2600 and are USDA approved.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

G. Source Limitations: Obtain each kind of joint sealant from a single source from a single manufacturer.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT. neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 790.
    b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
    c. Tremco Incorporated; Spectrem 1.

2. Joint Sealant Application: Exterior joints where one or both joint faces are masonry, stone, concrete or other porous materials and are not to be painted.

B. Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 999-A.
    b. GE Advanced Materials - Silicones; Contractors SCS1000.
    c. Tremco Incorporated; Proglaze.

2. Joint Sealant Application: Exterior joints where both joint faces are metal, glass, plastic, or other non-porous material and are not to be painted.

C. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT; formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 786 Mildew Resistant.
    b. GE Advanced Materials - Silicones; Sanitary SCS1700.
    c. Tremco Incorporated; Tremsil 200 Sanitary.

2. Joint Sealant Application: Interior joints between plumbing fixtures and floor or wall surfaces of non-porous materials and are not to be painted.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. BASF Building Systems; Sonolastic NP1.
    b. Pecora Corporation; Dynatrol I-XL.
    c. Sika Corporation, Construction Products Division; Sikaflex - 1a.

2. Joint Sealant Application: Exterior joints of hollow metal frames, exterior joints in concrete and masonry walls, and interior and exterior joints requiring painting.

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Sonolastic SL 1.
b. Pecora Corporation; Urexpan NR-201.
c. Sika Corporation. Construction Products Division; Sikaflex - 1CSL.

2. Joint Sealant Application: Interior concrete slab floor joints and exterior paving joints.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Sonolac.
b. Pecora Corporation; AC-20+.
c. Tremco Incorporated; Tremflex 834.

2. Joint Sealant Application: Interior non-moving joints between gypsum board and adjacent materials, trim, or similar surfaces.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard non-sag, paintable, non-staining latex acoustical sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:

a. GE Construction Sealants; RCS20 Acoustical.
b. Pecora Corporation; AC-20 FTR or AIS-919.
c. Tremco, Incorporated; Tremco Acoustical Sealant.
d. USG Corporation; SHEETROCK Acoustical Sealant.

2. Joint Sealant Application: Interior joints of acoustically rated construction and where indicated on Drawings.

2.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for

applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin), as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Etch concrete and masonry joint surfaces as recommended by manufacturer to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid; neutralize with diluted ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

C. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

D. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

    1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Install sealant to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead:

1. For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.
2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but neither more than 1/2 inch deep nor less than 1/4 inch deep.
3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in range of 75 to 125 percent of joint width.

G. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces.

H. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

3.4 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. General: Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install

acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.5 FIELD QUALITY CONTROL

A. General: Provide field adhesion testing when required by manufacturer and/or installer for warranties required of manufacturer and/or installer.

B. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
    b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

C. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.6 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.7 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 081053

DOOR LOUVER AND LITE FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Door lite frames for hollow metal and laminate faced flush wood doors to comply with STC sound rating indicated.

2. Door louvers and frames for non-sound rated hollow metal or wood doors (if indicated in Mechanical drawings).

B. Related Sections:

1. Division 08 Sections "Hollow Metal Doors and Frames" for hollow metal doors.

2. Division 08 Sections "Plastic Laminate Faced Flush Wood Doors" for wood doors.
3. Division 08 Section "Glazing" for glass installed in door lite frames, including insulated units and laminated glass at sound rated doors.
4. Division 09 Sections “Painting” for field painting louvers and door lite frames.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, and finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain door lite frames and door louvers from a single source from a single manufacturer.

B. Basis of Design Manufacturer: In other Part 2 Articles where products are identified by Basis of Design named manufacturer and product, products are based on items manufactured by:

a. Anemostat Door Products.

1) Subject to compliance with requirements, provide products indicated, or comparable products by one of the following:

a) Activar Construction Products Group.
b) Alternate manufacturer subject to request for substitution.

2.2 DOOR LITE FRAMES

A. Metal Frames for Light Openings in Doors: Manufacturer's standard frame formed of steel sheet; factory primed for field finishing at non-sound rated doors; and specialty frames for sound rated doors indicated for STC sound ratings over 30 STC.

1. Basis of Design: Anemostat Door Products, LoPro or LoPro-IS Series as required for glass thickness and type indicated for STC sound rated doors.

2. Physical Characteristics:

a. Frame Material: Minimum 0.033 inch thick (20 gage) steel of material as follows:

1) Interior Door Lite Frames: Cold rolled steel of thickness indicated.
2) Exterior Door Lite Frames: Hot dipped galvanized of thickness indicated.

b. Size: As indicated on Drawings.
c. Glazing Thickness: As required for door sound rating indicated on Drawings.
d. Finish: Baked enamel, color as selected by Architect from manufactures complete color range.
e. Fasteners: Oval head Phillips wood or sheet metal screws.

1) Provide one-way vandal resistant oval head wood or sheet metal screws at exterior doors.

3. Fire Rating: Where door assemblies are indicated to be fire rated, provide door lite frames having fire rating of time period indicated.

a. Fire-rated door lite assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

2.3 DOOR LOUVERS (if required in mechanical drawings)

A. Security Louvers: Manufacturer's standard security louver with frame formed of steel sheet and security grille each side; factory primed for field finishing.

1. Basis of Design: Anemostat Door Products, PLSL Series louver with security grille.

1) Subject to compliance with requirements, provide product indicated or comparable products by one of the following:

a) Approved equivalent subject to request for substitution.

2. Physical Characteristics:

a. Material:

1) Interior Door Louvers: Cold rolled steel of thickness indicated.
2) Exterior Door Louvers: Hot dipped galvanized of thickness indicated.

b. Security Grille: 0.1046 inch thick (12 gage) steel each side of door with 13/16 inch square holes spaced 1 inch on center each way.
c. Louver Blades: 0.032 inch thick (20 gage) steel, non-vision inverted split 'Y'.
d. Size: As indicated on Drawings.
e. Free Ventilating Area: 50%.
f. Finish: Baked enamel.
g. Fasteners: One-way vandal resistant oval head through bolt, blank one end.
h. Insect Screens: Provide galvanized insect screens for exterior door louvers installed between split louvers.

2.4 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy coating designation.

D. Glazing: Comply with requirements in Division 8 Section "Glazing."

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install door louvers, louver frames, and lite frames in accordance with manufacturer's written instructions. At sound rated doors, fill voids in frame with rock wool mineral fiber insulation and/or manufacturer's recommended acoustical sealant.

1. At fire-protection-rated door lite openings, install frames according to NFPA 80.

B. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with manufacturer's written instructions, including insulated glass units and various

thicknesses of laminated glass as required for STC sound ratings indicated in drawings.

END OF SECTION

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Standard and custom hollow metal doors and frames.
2. Hollow metal doors and frames installed in exterior CMU wall utility yard enclosure.

B. Related Sections:

1. Division 08 Section “Door Louver and Light Frames” for door louver and light frames in doors.
2. Division 08 Section “Plastic Laminate Faced Flush Wood Doors” for plastic laminate faced flush wood doors installed in hollow metal frames.
3. Division 08 Section "Door Hardware" for door hardware for hollow metal doors and frames.
4. Division 08 Section "Door Hardware" for inspection and testing of:

    a. Fire rated door openings.
    b. Doors with panic hardware.
    c. Door openings with electrified hardware.

5. Division 08 Section "Glazing" for glass installed in hollow metal doors and frames.
6. Division 09 Sections “Painting” for field painting hollow metal doors and frames.
7. Division 26 through 28 Sections as applicable for electrical connections including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.
2. Door and frames to be stacked in a vertical upright position.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.

B. Coordinate requirements for preparation and installation of electrified door hardware and access control and security systems.

C. Hardware Templates: Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

3. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Krieger Specialty Doors
2. Amweld Building Products, LLC.
3. Ceco Door Products; an Assa Abloy Group company.
4. Curries Company; an Assa Abloy Group company.
5. Deansteel Manufacturing Company, Inc.

6. Metal Products Incorporated (MPI).
7. Steelcraft; an Ingersoll-Rand company.
8. Stiles Custom Metal, Inc.
9. Windsor Republic Doors.

B. Source Limitations: Obtain hollow metal work from a single source from a single manufacturer.

2.3 HOLLOW METAL DOORS

A. General: Hollow metal doors shall comply with ANSI/SDI A250.8, ANSI/NAAMM HMMA 867, and with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

1. Type/Design: Flush panel unless otherwise indicated on the Drawings.
2. Door Thickness: 1-3/4 inches unless otherwise indicated.
3. Vertical Edges for Single-Acting Doors: Beveled, 1/8 inch in 2 inches.
4. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
5. Openings: Factory cut openings in doors.
6. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
7. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
8. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
9. Exposed Finish: Factory prime finish for field painting.

B. Exterior Doors: Doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level.

1. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 0.053 inch (16 gauge) thick steel, Model 2.
2. Face Sheet Material: Metallic-coated steel sheet.
3. Edge Condition: Model 1, full flush; vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth.
4. Core Construction: Manufacturer's standard polyurethane core with minimum 3.2 R-value unless otherwise indicated.
    a. Fire Rated Doors: Manufacturer’s standard as required to comply with fire-protection and temperature-rise ratings indicated.
5. Top Edge Closures: Continuous steel channel of same material and thickness as face sheets flush with tops of doors and welded to the face sheet.

6. Bottom Edge Closures: Continuous steel channel of same material and thickness as face sheets welded to the face sheet. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.

C. Interior Doors: Doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level.

1. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 0.053 inch (16 gauge) thick steel, Model 2.
2. Face Sheet Material: Cold-rolled steel sheet.
3. Edge Condition: Model 1, full flush; vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth.
4. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces unless otherwise noted.

    a. Fire Rated Doors: Manufacturer’s standard as required to comply with fire-protection and temperature-rise ratings indicated.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

1. Fabricate frames with mitered or coped full profile welded corners unless otherwise indicated.
2. Fabricate frames to profiles indicated on drawings.
3. Frames shall be sized to provide full throat width equal to depth of wall including finishes plus 1/2 inch backbend on each side per SDI-100.

B. Exterior Frames: Metallic-coated steel sheet, minimum thickness of 0.067 inch (14-gauge).

C. Interior Frames: Cold-rolled steel sheet, minimum thickness of 0.053-inch (16 gauge).

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Exposed Finish: Factory prime finish for field painting.

F. Hardware Reinforcement: Fabricate with reinforcement plates from same material as frames with minimum reinforcement according to ANSI/SDI A250.6 and the following:

1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
2. Lock Face, Closers, and Concealed Holders: Minimum 0.067 inch thick.
3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.

G. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

H. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

I. Plaster Guards: Formed from same material as frames, not less than 0.016-inch thick.

2.5 HOLLOW METAL DOORS AND FRAMES FOR CMU WALL UTILITY YARD

A. General: Comply with requirements specified for exterior hollow metal doors and frames and additional requirements specified in this Article.

B. Doors: Hollow metal doors installed in exterior CMU fencing walls shall have all 4 edges and faces fully welded and sealed to withstand the elements and be as indicated on the Drawings.

C. Frames: Hollow metal frames installed in exterior CMU fencing walls shall be as indicated on Drawings and have a four-sided head section extending the full width of the opening, be fully welded, and sealed to prevent water intrusion.

1. The concealed side of frames shall be coated with a bituminous coating and frames shall be prepared to be fully grouted.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.

a. Stud Wall Type: Metal stud wall type, minimum 0.042 inch thickness.
b. Masonry Wall Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2. Quantity: Minimum of four anchors per jamb.

a. One anchor may be omitted where floor anchors are provided.
b. Provide one additional jamb anchor for each 24 inches of frame height above 7 feet.

2.7 STOPS AND MOLDINGS

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch high, unless otherwise indicated.

2.8 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy coating designation.

1. Material indicated to be fabricated from metallic coated steel sheet shall be of galvannealed steel sheet.

D. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Glazing: Comply with requirements in Division 8 Section "Glazing."

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.9 FABRICATION

A. General: Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

F. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
5. Provide stops for installation with countersunk flat or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.10 STEEL FINISHES

A. Prime Finish: Doors and frames to be cleaned and chemically treated to insure maximum paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for

substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
2. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition; tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

C. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

D. Prior to installation of frames to be grouted or cast in concrete, provide 1/4 inch thick rigid compressible filler material at templated and surface mounted hardware locations at concealed surfaces of frames to facilitate the installation of hardware fasteners and to allow for field drilling and tapping.

3.3 INSTALLATION

A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames

properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in compliance with NFPA 80.
3. Insulation: Solidly pack rock wool mineral-fiber insulation inside frames that are not to be grouted.
4. Installation Tolerances: Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances. Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Doors: Comply with ANSI/SDI A250.8 as follows:

a. Between Door and Frame at Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. Between Edges of Pairs of Doors: 1/8 inch minimum, 1/4 inch maximum.
c. At Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
e. Between Door Face and Face of Stop: 1/16 inch minimum, 1/8 inch maximum.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105 or UL 1784 for positive pressure requirements.
4. Sound control STC rated Doors: Fit doors snugly to door frames after insulating and/or grouting to seal off voids and openings that allow passage of sound.
5. Hardware: Install sound seals and other included hardware to doors as required for complying with STC sound rating indicated.

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat or oval-head machine screws spaced uniformly not more than 9 inches on center and not more than 2 inches on center from each corner.

3.4 ADJUSTING AND REPAIR

A. Final Adjustments: Final adjustment as specified in Division 08 Section “Door Hardware.”

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 081423

PLASTIC LAMINATE FACED FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core flush wood doors with plastic laminate faces, including fire and sound rated doors.

B. Related Sections:

1. Division 08 Section “Door Louver and Lite Frames” for louver and light frames for wood doors.
2. Division 08 Section “Hollow Metal Doors and Frames” for door frames for wood doors.
3. Division 08 Section “Interior Aluminum knock-down Frames” for door frames for wood doors.
4. Division 08 Section “Door Hardware” for door hardware for doors.
5. Division 08 Section "Door Hardware" for testing of fire rated door installations egress doors with panic hardware and/or electrified hardware.

1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of cutouts.

C. Schedule: Provide a schedule prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Samples for Initial Selection: For plastic laminate door faces.

E. Warranty: Sample of special warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons. Wrap bundles of doors in plastic sheeting for doors packaged in cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period. Comply with manufacturer’s published recommendations.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to the following:

    a. Delamination of veneer.
    b. Warping (bow, cup, or twist) more than 1/4 inches in a 42-by-84-inch section.
    c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inchspan.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Algoma Hardwoods Inc.
2. Chappell Door Co.
3. Eggers Industries; Architectural Door Division.
4. Marshfield Door Systems, Inc

5. VT Industries Inc.
6. Maiman Door Co.

B. Source Limitations: Obtain plastic laminate faced flush wood doors from one source from a single manufacturer.

2.2 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

A. General Description: Interior, solid core of type required for fire rating and/or STC sound rating of minimum 35 STC (including vision lites), five-ply flush wood doors with plastic laminate faces.

B. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

C. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

D. Fire-Rated Wood Door Assemblies: Where fire rated assemblies are indicated, provide assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

E. Sound-Rated Wood Door Assemblies: Where STC sound rated assemblies are indicated, provide assemblies complying with ASTM E90, E1332, E2235, E413, SDI128 and HMMA criteria applicable to wood door assemblies for required Sound Transmission Classification (STC) based on third party testing.

F. Interior Doors:

1. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
2. ANSI/WDMA I.S. 1A Grade: Premium.
3. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.

    a. Colors, Patterns, and Finishes: As selected by Architect from laminate manufacturer's full range of products.

4. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.
5. Exposed Vertical Edges: Plastic laminate that matches faces, applied before faces.

    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.

    b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals.

Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

6. Cores:

a. Provide cores as follows:

1) Particleboard unless otherwise indicated.
2) Structural-composite-lumber cores in lieu of particleboard cores for doors indicated to receive exit devices as indicated on the Drawings and scheduled in Division 08 Section “Door Hardware.”
3) Mineral core doors where required for fire resistance rating(s) indicated.
4) Sound core doors where required for STC sound rating indicated.

b. Particleboard Core Doors: Particleboard, ANSI A208.1, Grade LD-2 unless otherwise indicated or required for fire or sound rating, and made with binder containing no urea-formaldehyde resin.

1) Blocking for Particleboard and soft core Doors: Provide wood blocking in particleboard-core and other soft core doors as needed to eliminate through-bolting hardware.

c. Structural Composite Lumber Cores: WDMA I.S. 10 structural-composite-lumber cores containing no urea-formaldehyde resin.

1) Screw Withdrawal, Door Face: 550 lbf.
2) Screw Withdrawal, Vertical Door Edge: 550 lbf.

d. Mineral and Sound Core: As required to achieve fire-protection and sound transmission rating indicated on Drawings.

1) Blocking for Mineral-Core and Sound-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.

2.3 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

2. Comply with requirements of ASTM or other testing for sound-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Vision Panels: Openings in doors for vision panels or other glazing shall be such that the bottom edge of visible glass shall be not more than 43 inches above the finished floor surface (Ref. CBC 11B-404.2.11).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For hardware and hardware installation, refer to Division 08 Section "Door Hardware."

B. Installation: Install doors to comply with manufacturer's written installation instructions, referenced quality standards, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

2. Install sound seals, astragals and other sound blocking items required for sound-rated doors.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Factory Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083113

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:

1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:

1. Division 07 Section "Roof Access Hatches" for roof hatches.
2. Division 22 and 23 Sections as applicable for access to Plumbing and Mechanical valves and equipment behind finished surfaces.
3. Division 26 Sections as applicable for access to Electrical equipment behind finished surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.

B. Access Door and Frame Schedule: Provide access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.4 COORDINATION

A. Coordinate locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work with mechanical and plumbing trades.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per

the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babcock-Davis.
2. Dur-Red Products.
3. J. L. Industries, Inc.
4. Karp Associates, Inc.
5. Larsen's Manufacturing Company.
6. Milcor Inc.
7. Nystrom, Inc.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Non-Fire Resistance Rated Flush Access Doors and Frames with Exposed Trim: Access doors with face of door flush with frame, with exposed flange and concealed hinge.

1. Material:

a. Uncoated or Metallic Coated Steel Sheet:

1) Locations: Non-fire resistance rated wall and ceiling surfaces of painted gypsum board.
2) Doors: Nominal 0.060 inch (uncoated) or 0.064 inch (coated) (16 gage) thickness.
3) Frames: Nominal 0.060 inch (uncoated) or 0.064 inch (coated) (16 gage) thickness.
4) Finish: Factory prime finish, manufacturer’s standard baked on rust inhibitive gray primer.

b. Stainless Steel Sheet:

1) Locations: Non-fire resistance rated wall and ceiling surfaces with ceramic tile finish or prefinished wall paneling.
2) Doors: Nominal 0.062 inch (16 gage) thickness.
3) Frames: Same material and thickness as doors.
4) Finish: No. 4.

2. Hinges: Manufacturer’s standard concealed spring pin hinge.
3. Latch/Lock:

a. Latch: Cam latch operated by screwdriver with interior release.

1) Provide where access doors are located in private or semi-private areas such as office spaces, storage rooms, equipment rooms, and private toilet rooms.

b. Lock: Manufacturer’s standard key operated cylinder cam lock. Furnish two keys per lock and key all locks alike.

1) Provide where access doors are located in public areas such as exterior walls and ceilings, and public toilet rooms.

4. Size: As indicated on drawings or as required to provide access to valves and equipment concealed behind finished surfaces.

D. Fire-Rated, Flush Access Doors and Frames with Exposed Trim:

1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Material:

a. Uncoated or Metallic Coated Steel Sheet:

1) Locations: Fire resistance rated wall and ceiling surfaces of painted gypsum board.
2) Doors: Nominal 0.036 inch (uncoated), 0.40 inch (coated) (20 gage) thickness.
3) Frames: Nominal 0.060 inch (uncoated) or 0.064 inch (coated) (16 gage) thickness.
4) Finish: Factory prime finish, manufacturer’s standard baked on rust inhibitive gray primer.

b. Stainless Steel Sheet:

1) Locations: Fire resistance rated wall and ceiling surfaces with ceramic tile finish or prefinished wall paneling.
2) Doors: Nominal 0.038 inch (20 gage) thickness.
3) Frames: Nominal 0.062 inch (16 gage) thickness.
4) Finish: No. 4.

4. Hinges: Manufacturer’s standard flush continuous piano hinge.
5. Closer: Spring type, automatic acting.
6. Latch/Lock:

a. Latch: Knurled knob operated latch.

1) Provide where access doors are located in private or semi-private areas such as office spaces, storage rooms, equipment rooms, and private toilet rooms.

b. Lock: Manufacturer’s standard key operated cylinder cam lock. Furnish two keys per lock and key all locks alike.

1) Provide where access doors are located in public areas such as exterior walls and ceilings, and public toilet rooms.

7. Size: As indicated on drawings or as required to provide access to valves and equipment concealed behind finished surfaces.

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

1. Finish: Directional satin finish, No. 4.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Size: As indicated on Drawings or size as required for access to concealed spaces, valves, or equipment.

1. Access to attic spaces shall not be less than 22 x 30 inches clear opening.
2. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

C. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

D. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
2. Provide mounting holes in frames for attachment of units to metal or wood framing, mounting holes shall not be located in exposed surfaces of frames.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil for topcoat.

E. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

    a. Run grain of directional finishes with long dimension of each piece.
    b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
    c. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 083213

ALUMINUM FRAMED SLIDING GLASS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes multi-panel thermally broken aluminum-framed sliding glass doors for exterior locations.

B. Related Sections:

1. Division 08 Section “Glazing” for glazing for aluminum framed sliding glass doors.

1.3 ACTION SUBMITTALS

A. Product Data: For sliding glass doors and hardware; include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. Shop Drawings: For sliding glass doors.

1. Include plans, elevations, sections, and details.
2. Detail attachments to other work, and between units, if any.
3. Include hardware and required clearances.

C. Governing Agency Deferred Approval: Projects under the jurisdiction of the Division of the State Architect (DSA) require the design of window framing members to be reviewed and approved by the Division of the State Architect through a Deferred Approval when the project includes window framing members having spans exceeding 10 feet in length. When a deferred approval is required, the deferred approval submittal shall be applicable to all windows regardless of span. Refer to DSA Interpretive Regulation IR 24-2 for additional information; IR 24-2 is available on DSA’s website.

1. Window system Deferred Approval submittal shall include necessary shop drawings, details, and structural calculations prepared, stamped, and signed by a structural engineer licensed in the State of California. The window system supplier or installer shall be responsible for the design and engineering calculations and drawings, and shall be responsible for responding to and resolving any comments from the DSA.

2. The Deferred Approval submittal shall be submitted to the Architect through the General Contractor. The Architect will transmit the Deferred Approval submittal to the Division of the State Architect.

D. Samples: For each exposed product and for each color specified, 12-inch-long section with weather stripping, sound seals, glazing bead, and factory-applied color finish.

E. Product Schedule: For sliding aluminum-framed glass doors, use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes, weather stripping, operable panels, and operating hardware to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to sliding aluminum-framed glass door manufacturer for installation of units required for this Project.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Accessibility Requirements, General: Comply with applicable requirements of the 2010 ADA Standards for Accessible Design, ICC/ANSI A117.1, and the California Building Code Chapter 11B.

B. Thresholds and Floor Tracks:

1. Openings: Openings shall not allow the passage of a sphere more than 1/2 inch in diameter; elongated openings shall have the long dimension perpendicular to the direction of travel (CBC 11B-302.3).
2. Changes in Level: Changes in level from an adjacent floor surface shall not exceed 1/2 inch; changes in level not exceeding 1/4 inch may be vertical and without edge treatment; changes in level between 1/4 inch and 1/2 inch shall be beveled with a slope not steeper than 2H:1V (CBC 11B-303).

C. Operating Force: The force required to open a sliding door shall not exceed 5 lbs (CBC 11B-404.2.9).

D. Clear width: Doors shall provide a clear width of not less than 32 inches (CBC 11B-404.2.3)

E. Operating Hardware (CBC 11B-404.2.7):

1. Handles, pulls, locks and other operable parts on doors shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist; the force required to activate operate parts shall be 5 lbs maximum (CBC 11B-309.4).
2. Operating hardware shall be located between 34 inches minimum and 44 inches maximum above the floor level.
3. When sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides.
4. Locking hardware shall be usable from the interior for unlocking at all times and shall be capable of interfacing with electronic access control devices from both sides.

2.2 SLIDING ALUMINUM-FRAMED GLASS DOORS

A. Aluminum Framed Sliding Glass Doors: Manufacturer's standard sliding glass door package as herein specified, with multiple fixed end panel and sliding panels as indicated.

B. Source Limitations: Obtain sliding aluminum-framed glass doors from single source from a single manufacturer.

C. Basis of Design: Design, Drawings and Specifications are based on the following:

1. Arcadia Architectural Products, Inc.; Series ULT-5920, thermally broken aluminum framed multi-sliding glass doors.

    a. Subject to compliance with requirements, provide specified product or a comparable product subject to submission and approval of a substitution request per Division 01 Section "Substitution Procedures.

D. Characteristics:

1. Configuration: 6 panel bi-parting, OXX / XXO (O = fixed, X = sliding).
2. Framing: Manufacturer's standard thermally broken extruded aluminum sections fabricated from aluminum extrusions of 6063-T5 alloy and temper with a minimum wall thickness of 0.090 inch for the door frame sill member and a minimum of 0.072 inch for all other members.

    a. Head and Jambs: Manufacturer's standard built-up interconnected extruded aluminum sections, 6 inch overall nominal depth.
    b. Door Panels: Manufacturer's standard extruded aluminum sections.

        1) Glazing Thickness: 1 inch insulated glazing as indicated on Drawings.

            a) Glass and glazing per Division 08 Section "Glazing."

c. Thermal Break: Thermal break barrier shall consist of a two-part, chemically curing, high-strength urethane and shall provide a continuous uninterrupted thermal separation around the entire perimeter of the panel or framing components.
d. Finish: Clear anodized aluminum.

3. Component parts and accessories shall be of aluminum alloy, stainless steel or non-metallic materials.
4. Roller Assemblies: Operable panels shall be equipped with two adjustable stainless steel tandem rollers with 3 inch diameter polymer wheels.
5. Fasteners: Assembly and installation screws shall be 18-8 or 410 stainless steel.
6. Pulls: The center operating panels shall have interior pulls of 3/4 inch diameter 8 inch on center aluminum wire pull handles with finish matching framing members.
7. Threshold: Maximum 1/2 inch high threshold recessed into the floor slab as detailed on drawings.
8. Seals: Manufacturer’s standard resilient seals as required to achieve weather tight seals.
9. Locking Hardware: Morise locking device with stainless steel hook bolt, cylinder lock to be located on the interior side of the door panel, no exterior hardware.

    a. Locking Device: Adams Rite MS+1850.
    b. Lock cylinders shall be as specified in Division 08 Section “Door Hardware.”

2.3 FABRICATION

A. Fabricate sliding aluminum-framed glass doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

B. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling panel framing.

C. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Aluminum Finish: Clear anodic finish, AAMA 611.89, Class I, 7 mils thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage and conditions with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in compliance with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.

B. Install sliding aluminum-framed glass doors level, plumb, square, true to line, without distortion, without warp or rack of frames and panels; anchored securely in place to structural support; and in proper relation to adjacent construction. Fill voids at door frame perimeter with insulation and seal all edges with acoustical sealant.

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Lubricate hardware and moving parts as recommended by sliding door manufacturer and adjust operating panels to provide a tight fit at contact points and seals for smooth operation without binding. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

B. Clean exposed surfaces immediately after installing sliding aluminum-framed glass doors. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glass that has been damaged the during construction period.

D. Protect sliding aluminum-framed glass door surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact sliding aluminum-framed glass door surfaces, remove contaminants immediately according to manufacturer's written instructions.

E. Replace sliding aluminum-framed glass doors with damaged finishes.

F. Replace damaged components.

END OF SECTION

SECTION 083323

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes exterior insulated non-fire resistance rated motor operated overhead coiling doors.

B. Related Sections include but are not limited to the following:

1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.
2. Division 08 Section "Overhead Coiling Grilles” for interior overhead coiling grilles.
3. Division 08 Section “Door Hardware” for cylinders for locks.
4. Division 09 Section "Painting" for finish painting of factory-primed doors.
5. Division 26 Sections for electrical service and connections for powered operators and accessories.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory, include the following:

1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each color of exposed prefinished metal prepared on minimum 8inch by 8 inch sample.

E. Qualification Data: For Installer.

F. Seismic Qualification Certificates: For overhead coiling doors**,** accessories, and components, from manufacturer.

G. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

H. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of overhead coiling service doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the "2010 ADA Standards for Accessible Design" and the California Building Code Chapter 11B.

B. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:

1. Design Wind Load: As indicated on Drawings and not less than a uniform pressure (velocity pressure) of 16 lbf/sq. ft. (Strength Design LRFD), acting inward and outward.
2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

3. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

C. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.0.

2.2 MANUFACTURERS

A. Basis-of-Design Manufacturer: In other Part 2 Articles where named products are indicated, Design, Drawings and Specifications are based on products by the following:

1. Cornell Iron Works, Inc.

a. Subject to compliance with requirements, provide the product(s) indicated or a comparable product by one of the following:

1) Cookson Company.
2) McKeon Rolling Steel Door Company, Inc.
3) Overhead Door Corporation.
4) Raynor.

b. Overhead coiling doors specified in this Section and overhead coiling grilles specified in Division 08 Section “Overhead Coiling Grilles” shall be products of the same manufacturer.

B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.3 OVERHEAD COILING SERVICE DOORS

A. General Description: Overhead coiling doors as follows:

1. Opening Size: As indicated on Drawings.
2. Fire Rating: Non-fire rated.
3. Operation: Motor operated.
4. Slats: Flat, insulated.
5. Operation Cycles: Door components and operators capable of operating for not less than 20 cycles per day maximum and an overall maximum of 50,000 operating cycles for the life of the door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
6. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283.

B. Basis-of-Design: Design, Drawings and Specifications are based on the following:

1. Cornell Iron Works; model ESD30 Thermiser Max insulated overhead coiling door.

C. Door Curtain: Insulated curtain of interlocking slats designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Slat Material: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch (22 gage) and as required to meet requirements.
2. Profile: Flat profile slats of 2-5/8 inch nominal center-to-center height.
3. Insulated Slats: Slats for insulated doors shall be filled with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.

    a. Total Thickness of Insulated Slats: 15/16 inch.
    b. Curtain R-Value: 8.0 deg F x h x sq. ft./Btu minimum.
    c. Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
    d. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.

4. Slat Finish: Baked-enamel or powder-coated finish, color as selected by Architect from manufacturer's full range of custom colors.

    a. Interior Curtain-Slat Facing: Manufacturer’s standard interior finish.

D. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

E. Bottom Bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge. Minimum 4 inches tall x 1-1/16 inch thickness

F. Curtain Jamb Guides: Minimum 3/16 inch steel angles. Provide windlock bars of same material. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Slot bolt holes for guide adjustment. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.

G. Hood: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Profile: Round.

2. Mounting: Interior face of wall as is standard with manufacturer and as appropriate for project conditions.
3. Material and Finish: Galvanized steel, 24 gauge minimum, finish to match slats.
4. Exterior Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

H. Locking Device: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock cylinder as specified in Division 08 Section "Door Hardware" and keyed to building keying system.

I. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

J. Curtain Accessories:

1. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.

a. At door head, use 1/8-inch thick, replaceable, continuous sheet secured to inside of hood.
b. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch thick seals of flexible vinyl, rubber, or neoprene.
c. At door threshold, equip door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

2.4 COUNTERBALANCE MECHANISM

A. Counterbalance Mechanism: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.5 DOOR OPERATION

A. Electric Door Operator: Electric door operator assembly of size and capacity complying with specifications and as recommended by door manufacturer for door(s) specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
3. Usage Classification: Industrial duty, up to 20 cycles per hour.
4. Operator Location: Wall mounted; operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
5. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
6. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.

    a. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec.

        1) Voltage: 115-V AC, single phase, 60 Hz., unless otherwise indicated.

    b. Motor Exposure: Interior.

7. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

    a. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

8. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

B. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

C. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
2. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

D. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

C. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Installer present for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install power operated doors according to UL 325.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and perform startup checks according to manufacturer's written instructions.
2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 083326

OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electric motor operated overhead coiling grilles including tube support frames.

B. Related Sections include but are not limited to the following:

1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.
2. Division 08 Section “Overhead Coiling Doors” for overhead coiling doors.
3. Division 08 Section “Door Hardware” for cylinders for locks and access control devices.
4. Division 26 Sections for electrical service and connections for powered operators and accessories including wiring and conduit, fuses, disconnect switches, and installation of control stations.

1.3 SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory; include construction details, material descriptions, dimensions of individual components, profiles for slats, finishes, rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices, and other accessories.
5. Include diagrams for power, signal, and control wiring.

C. Qualification Data: For Installer.

D. Seismic Qualification Certificates: For overhead rolling grilles accessories, and components, from manufacturer.

E. Maintenance Data: For overhead rolling grilles to include in maintenance manuals.

F. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of overhead rolling grilles, operator and control panel that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the "2010 ADA Standards for Accessible Design" and the California Building Code Chapter 11B.

B. Seismic Performance: Overhead rolling grilles shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.0.

2.2 MANUFACTURERS

A. Basis-of-Design Manufacturer: In other Part 2 Articles where named products are indicated, Design, Drawings and Specifications are based on products by the following:

1. Cornell Iron Works, Inc.

a. Subject to compliance with requirements, provide the product(s) indicated or a comparable product by one of the following:

1) Cookson Company.

2) Overhead Door Corporation
3) McKeon Rolling Steel Door Company, Inc.
4) Raynor.

b. Overhead coiling grilles specified in this Section and overhead coiling doors specified in Division 08 Section “Overhead Coiling Doors” shall be products of the same manufacturer.

B. Source Limitations: Obtain overhead coiling grilles from a single source from a single manufacturer.

1. Obtain operators and controls from overhead coiling-grille manufacturer.

2.3 OVERHEAD COILING GRILLE ASSEMBLY

A. Overhead Coiling Grille: Motor operated, open curtain, overhead coiling grille.

1. Basis of Design: Cornell Iron Works, Inc.; Model ESG10C (Straight Pattern).

B. Cycle Life: Grille components and operators shall be designed to be capable of operating up to 5 cycles per day maximum, and an overall maximum of 50,000 operating cycles for the life of the grille. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

C. Curtain: Open curtain having a network of horizontal rods spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.

1. Horizontal Rods: Minimum 5/16 inch diameter solid aluminum 5056 H32 alloy rods with horizontal aluminum or stainless steel tube spacers to separate vertical links on alternate rods with continuous end tube spacers.

a. Vertical Spacing: 2.5 to 3.7 inches on center.

2. Vertical Chains: Solid 1/8 inch minimum stainless steel links, 1/4 inch wide, positioned by aluminum or stainless steel tube spacers on 9 inch centers with nylon insert nuts threaded on to the end of each rod to secure the chains.

a. Pattern: Straight.

3. Exposed Finishes:

a. Aluminum: Clear anodized.
b. Stainless Steel: Type 304, No. 4 satin finish.

D. Bottom Bar: Continuous extruded aluminum tubular shape, minimum 1.5 inches by 1.5 inches by 0.18 inches thickness, finished to match grille.

1. Provide motor-operated grilles with combination bottom astragal and sensor edge.

E. Curtain Jamb Guides: Manufacturer's standard extruded aluminum guides with snap on covers to conceal fasteners and with continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

1. Finish: Clear anodized.
2. Mounting: Tube mounted.

F. Hood: None.

A. Counterbalance Shaft Assembly:

1. Barrel: Minimum 6 inch diameter steel pipe with a 1-1/2 inch inner shaft capable of supporting curtain load with maximum deflection of 0.5125 inches per foot of width.
2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of grille to ensure that maximum effort to operate will not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.

B. Brackets: Fabricate from minimum 1/4 inch steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.

1. Finish: Powder coat, phosphate treatment followed by a gray baked-on polyester powder coat; minimum 2.5 mils cured film thickness.

C. Locking Device: Single-jamb side locking bar, operable from outside with cylinder.

1. Provide with interlock system to prevent damage to door and operator when grilles are mechanically locked.

D. Electric Operator: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.

1. Basis of Design: Cornell Iron Works, Inc,; Model MG Electric Motor Operator.
2. Rating: Rated for a maximum of 20 cycles per hour.
3. Horsepower: As recommended by grille manufacturer, 1/2 horsepower minimum.
4. Voltage: 120-V ac, single phase, 60 Hz.
5. Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device.
6. Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position.
7. Operator drive and door driven sprockets shall be provided with #50 roller chain.
8. Provide an integral Motor Mounted Interlock system to prevent damage to door and operator when mechanical door locking devices are provided.
9. Operator shall be capable of driving the door at a speed of 6 to 9 inches per second.
10. Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door.

E. Control Station: Flush mounted; "Open/Close" key switch with "Stop" push button, NEMA 1B.

1. Provide with constant pressure close operation to meet UL325-2010 listing standard requirements.

F. Obstruction-Detection Device: Continuously monitored, wireless sensing edge seal extending full width of door bottom bar. Contact with sensing edge before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Wireless edge kit shall use Zigbee wireless technology. Radio band wireless sensing edges will not be permitted.

1. Cornell Iron Works, Inc.; Smartsync Wireless Edge Kit.

G. Mounting/Support Tubes: Manufacturer's standard mounting tubes, saddles, and hardware designed to support grille; factory fabricated from ASTM A36/A36M structural-steel tubes, fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

1. Finish: Hot-dip Galvanized: ASTM A 123, Grade 85 zinc coating, hot-dip galvanized after fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Installer present for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead grilles, controls, and operators at the mounting locations indicated for each grille.

C. Accessibility: Install switches and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that grilles operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION

SECTION 083819
TRAFFIC DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Traffic doors at kitchen area.
2. Stainless steel hollow metal fully welded frame with anchors and accessory reinforcement.
3. Hardware and accessories.

B. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames” for other metal door frames.
2. Division 08 Section "Door Louver and Lite Frames” for other door lites.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For each product requiring color selections.

D. Maintenance Data: For traffic doors to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA)

and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities," ICC/ANSI A117.1, and the California Building Code. Vision window shall be located with bottom of view area to be within 43 inches of floor.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for traffic doors by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 TRAFFIC DOORS

A. Basis-of-Design Product: Drawings and Specifications are based on the following:

1. Eliason Corporation; SCG-3 stainless steel traffic door, medium to heavy use, and stainless steel hollow metal frame.

a. Subject to compliance with requirements, provide product indicated or a comparable product subject to request for substitution.

B. Description: High impact traffic door with moisture resistant composite wood core.

1. Door Thickness: one inch total door thickness.
2. Door Faces: 20 gage stainless steel door skins.
3. Gaskets: Full perimeter seal.
4. Window: 9 inch wide by 30 inch high window with black ABS frame, clear acrylic glazing.
5. Door Size: 42 inch wide by 84 inch high (nominal).
6. Jamb Guard: 3 by 9 inch jamb guard, stainless steel.
7. Hinges: Double action Easy Swing proprietary hinges, stainless steel.
8. Color: Satin finish stainless steel.

C. Frame Description: Stainless steel 16 gauge hollow metal drywall cased opening frame.

1. Corners: Fully welded.
2. Anchors: Stainless steel straps, 3 per side and bottom floor anchor.
3. Furnish complete with steel reinforcing for hinges and other accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Install frames in metal stud wall opening prior to installation of drywall and other finishes. Protect frame from damage until ready for door installation.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation.

END OF SECTION

SECTION 084113

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior and exterior aluminum framed storefront systems.
2. Aluminum framed entrance doors.

B. Related Sections:

1. Division 08 Section "Aluminum Framed Sliding Glass Doors" for aluminum sliding glass doors.
2. Division 08 Section “Siding Automatic Entrances” for aluminum framed automatic entrance door systems.
3. Division 08 Section “Aluminum Curtain Walls” for aluminum curtain wall systems.
4. Division 08 Section "Door Hardware" for swinging aluminum entrance door hardware not specified in this section.
5. Division 08 Section "Glazing" for glass for glazing of aluminum storefront systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems, including at windows and doors to achieve a minimum of 35 STC sound rating as indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. Include details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.

d. Glazing.
e. Flashing and drainage.

3. Include point to point wiring routing for electrically operated or controlled door operating hardware.

C. Governing Agency Deferred Approval: Projects under the jurisdiction of the Division of the State Architect (DSA) require the design of window framing members to be reviewed and approved by the Division of the State Architect through a Deferred Approval when the project includes window framing members having spans exceeding 10 feet in length. When a deferred approval is required, the deferred approval submittal shall be applicable to all windows regardless of span. Refer to DSA Interpretive Regulation IR 24-2 for additional information; IR 24-2 is available on DSA's website.

1. Window system Deferred Approval submittal shall include necessary shop drawings, details, and structural calculations prepared, stamped, and signed by a structural engineer licensed in the State of California. The window system supplier or installer shall be responsible for the design and engineering calculations and drawings, and shall be responsible for responding to and resolving any comments from the DSA.
2. The Deferred Approval submittal shall be submitted to the Architect through the General Contractor. The Architect will transmit the Deferred Approval submittal to the Division of the State Architect.

D. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

E. Qualification Data: For installer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

G. Field quality-control reports.

H. Sample Warranties: For special warranties.

I. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of

components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.5 MOCKUPS

A. Mockups: Build mockups to verify compliance with Specifications, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups at location(s) as directed by Architect.

    a. At least one mockup shall be required for each different installation condition and shall include head, jamb, and sill conditions.

2. Mockup of storefront framing shall be integrated and coordinated with associated weather resisting components including but not limited to weather resistive barriers, exterior wall insulation, flashing, wall finishes.
3. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 COORDINATION

A. Coordinate installation of products specified in this Section with installation of products specified in the following Sections:

1. Division 07 Section “Weather Resistive Barriers.”
2. Division 07 Section “Sheet Metal Flashing and Trim.”
3. Additional Sections as applicable to products comprising exterior wall finishing materials and/or systems.
4. Division 09 Section “Gypsum Board.”

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design aluminum-framed entrances and storefronts, including comprehensive engineering analysis, using performance requirements and design criteria indicated.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

    a. Deflection exceeding specified limits.
    b. Thermal stresses transferring to building structure.
    c. Glass breakage.
    d. Noise or vibration created by wind and thermal and structural movements.
    e. Loosening or weakening of fasteners, attachments, and other components.
    f. Failure of operating units.
    g. Sealant failure.

C. Structural Design Wind Loads: Storefront assemblies shall be designed to withstand wind loads determined according to ASCE/SEI 7 and the California Building Code.

1. Wind Loads: As indicated on Drawings and not less than 16 lbf/sq. ft. (Strength Design LRFD), acting inward and outward.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

E. Structural Testing: Aluminum-framed storefront systems shall comply with testing according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Water Penetration Under Static Pressure: Test according to ASTM E331; there shall be no evidence water penetration through fixed glazing and framing areas, including entrance doors, when tested according to minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than of 6.25 psf.

G. Seismic Performance: Aluminum framed entrances and storefront assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the California Building Code.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

H. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor): U-factor for the system of not more than the following as determined according to NFRC 100 and 2022 California Energy Code Table 110.6-A.

    a. Fixed Glazing and Framing Areas: 0.41 Btu/sq. ft. x h x deg F.
    b. Glazed Entrance Doors: 0.45 Btu/sq. ft. x h x deg F.

2. Solar Heat-Gain Coefficient (SHGC): SHGC for the system of not more than indicated below as determined according to NFRC 200 and 2022 California Energy Code Table 110.6-B.

    a. Fixed Glazing: 0.26.
    b. Glazed Entrance Doors: 0.23.

3. Air Leakage: Air leakage of not more than the following at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. when tested according to NFRC 400 or ASTM E 283.

    a. Fixed Glazing: 0.06 cfm/sq for the window system area.
    b. Single Entrance Doors: 0.3 cfm/sq. ft.
    c. Pairs of Entrance Doors: 1.0 cfm/sq. ft.

4. Condensation Resistance Factor (CRF):

    a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined according to AAMA 1503.

    b. Entrance Doors: CRF of not less than 57 as determined according to AAMA 1503.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes of 120 degrees F ambient and 180 degrees F material surface.

J. Accessibility Requirements for Entrances: Comply with applicable requirements of the 2010 ADA Standards for Accessible Design, ICC/ANSI A117.1, and the California Building Code.

2.2 MANUFACTURERS

A. Basis-of-Design Products: In other Part 2 Articles where named manufacturer's products are indicated as "Basis of Design," design, Drawings and Specifications are based on products manufactured by:

1. Kawneer North America; an Alcoa Company.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) EFCO Corporation.
2) Oldcastle Building Envelope.
3) United States Aluminum.
4) Arcadia Architectural Products, Inc.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from a single source from a single manufacturer.

2.3 INTERIOR STOREFRONT FRAMING SYSTEMS

A. Framing Members: Manufacturer's extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

a. Kawneer; Trifab VersaGlaze 451 (Non-thermal), screw-spline assembly.

2. Size: 2 by 4-1/2 inches.
3. Wall Thickness: Not less than 0.080 inches.
4. Construction: Non-thermally broken.
5. Glazing System: Retained mechanically with gaskets on four sides, may be installed from inside or outside.
6. Glazing Plane: Front.
7. Glazing Thickness: 1/4 inch.
8. Finish: Clear anodic finish.
9. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
10. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

2.4 EXTERIOR STOREFRONT FRAMING SYSTEMS

A. Framing Members: Manufacturer's extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

a. Kawneer; Trifab VersaGlaze 601T, Front Set Glazing, screw-spline assembly.

2. Size: 2 inches by 6 inches.
3. Wall Thickness: Not less than 0.080 inches.
4. Construction: Thermally broken.
5. Glazing System: Retained mechanically with gaskets on four sides, may be installed from inside or outside.
6. Glazing Plane: Front.
7. Glazing Thickness: 1-inch.
8. Finish: Clear anodic finish.
9. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
10. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

2.5 ENTRANCE DOOR SYSTEMS

A. Standard Duty Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation fabricated from extruded-aluminum tubular stiles rails. Single acting doors with hinges, or offset pivots per hardware schedule.

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

a. Kawneer 500 wide stile entrance.

2. Door Stile Design: Wide stile design.

a. Vertical Stiles: 5 inches nominal width not including glazing stops.
b. Top Rail: 5 inches wide minimum not including glazing stops.
c. Bottom Rail: 10 inches wide minimum not including glazing stops.

3. Door Width and Height: As indicated on Drawings.
4. Overall Thickness: 1-3/4 inches.
5. Material Thickness: 0.125 inch thick, extruded-aluminum tubular rail and stile members.

6. Glazing Thickness:

    a. Exterior Doors: 1 inch thick insulated glazing
    b. Interior Doors: 1/4-inch thick glazing.

7. Finish: Clear anodized.

B. Glazing Stops and Gaskets: 0.050 inch thick, square, snap-on, extruded-aluminum stops and preformed gaskets.

1. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Division 08 Section "Door Hardware."

B. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

C. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

2.7 GLAZING

A. Glazing: Glazing shall be as specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Glazing Sealants: As recommended by storefront system manufacturer.

1. Sealants shall comply with requirements specified in Division 07 Section “Joint Sealants.”
2. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Framing System Gaskets: Manufacturer's standard as recommended by manufacturer.

C. Perimeter Joint Sealants: As recommended by storefront system manufacturer.

1. Sealants shall comply with requirements specified in Division 07 Section “Joint Sealants.”
2. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

F. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.9 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

C. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.10 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior or exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using screw spline system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. Provide compression weatherstripping at fixed stops at all doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.
3. Door stiles and rails shall have hairline joints at corners. Heavy concealed reinforcement brackets shall be secured with screws and shall be of deep penetration and fillet welded.
4. All doors shall have an adjusting mechanism in the top rail to provide for minor clearance adjustments.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

A. Clear Anodic Finish: AAM10C21A41, Architectural Class, 0.7 mils minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

I. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

J. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

K. Install glazing as specified in Division 08 Section "Glazing."

L. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weatherstripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

M. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts as directed by Architect.

1. Testing shall be performed by the Contractor in the presence of the Owner’s Inspector. The Owner’s Inspector shall be responsible for observing and reporting results of testing.

2. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

   a. Perform a minimum of three tests at areas as directed by Architect.

B. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

C. Inspection Reports: Inspection reports shall be prepared by the Owner's Inspector.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer and as specified in Division 8 Section "Door Hardware."

END OF SECTION

SECTION 084229
SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes exterior, sliding, power-operated automatic entrances, bi-parting with emergency break away panels and transom above.

B. Related Requirements:

1. Division 03 Section “Cast-in-Place Concrete” for forming recesses in concrete for recessed thresholds.
2. Division 07 Section “Joint Sealants” for sealants.
3. Division 08 Section “Glazed Aluminum Curtain Walls” for framing, that the sliding Automatic Entrances will be installed within.
4. Division 08 Section “Glazing” for glazing for sliding automatic entrance doors.
5. Division 08 Section “Interior Aluminum Sliding Glass Doors” for interior manual sliding glass doors.

1.3 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.

D. For automatic door terminology, refer to BHMA A156.10 for definitions of terms.

1.4 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed sliding tracks that control automatic entrances. Concrete, reinforcement, and formwork requirements are specified elsewhere.

B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances.

C. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.

D. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies and access-control system.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrances.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For automatic entrances.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Indicate locations of activation and safety devices.
5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.

C. Samples for Initial Selection: For units with factory-applied color and/or metal finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Delegated-Design Submittal: For automatic entrances.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of automatic entrance. Include emergency-exit features of automatic entrances serving as a required means of egress.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems to include in operation and maintenance manuals.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than three hours' normal travel time from Installer's place of business to Project site.

B. Certified Inspector Qualifications: Certified by AAADM.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Faulty operation of operators, controls, and hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AUTOMATIC ENTRANCE ASSEMBLIES

A. Source Limitations: Obtain sliding automatic entrances from a single source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Power-Operated Door Standard: BHMA A156.10.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design automatic entrances.

B. Structural Performance: Automatic entrances shall withstand the effects of gravity, wind, and seismic loads and stresses within limits and under conditions indicated according to ASCE/SEI 7 and the California Building Code for the place in which the project is located.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Operating Temperature Range: Automatic entrances shall operate within minus 20 to plus 122 deg F.

E. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 1.25 cfm/sq. ft. of fixed entrance-system area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft..

F. Opening Force:

1. Power-Operated Doors: Not more than 50 lbf required to manually set door in motion if power fails, and not more than 15 lbf required to open door to minimum required width.

2. Breakaway Device for Power-Operated Doors: Not more than 50 lbf required for a breakaway door or panel to open.

G. Entrapment-Prevention Force:

1. Power-Operated Sliding Doors: Not more than 30 lbf required to prevent stopped door from closing.

2.3 SLIDING AUTOMATIC ENTRANCES

A. General: Provide manufacturer's standard automatic entrances including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.

B. Sliding Automatic Entrance Door 100A:

1. Basis of Design: Design, Drawings and Specifications are based on the following:

a. Stanley Access Technologies; Dura-Glide 2000; Bi-Parting unit with 1 ¾" inch by 4 ½" aluminum jambs and four all glass stile and rail panels.

1) Subject to compliance with requirements, provide the product indicated or a comparable product by one of the following:

a) Horton Automatics; a division of Overhead Door Corporation.
b) Assa Abloy/Besam Entrance Solutions.

2. Configuration: Biparting-sliding full-glass stile and rail doors with two sliding leaves, two full-glass fixed stile and rail sidelites on each side. (Four equal panels, total, all with break-way swing features).

    a. Traffic Pattern: Two way.
    b. Emergency Breakaway Capability: Sliding leaves only.
    c. Mounting: Between jambs of curtain wall system.

3. Operator Features:

    a. Power opening and closing.
    b. Drive System: Manufacturer's Standard**.**
    c. Adjustable opening and closing speeds.
    d. Adjustable hold-open time between zero and 30 seconds.
    e. Obstruction recycle.
    f. On-off/hold-open switch to control electric power to operator, access card activated.

4. Sliding-Door Carrier Assemblies and Overhead Roller Tracks: Carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.

    a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.

5. Sliding-Door Threshold: Threshold members and bottom-guide-track system with stainless-steel, ball-bearing-center roller wheels.

    a. Configuration: No threshold across door opening and recessed guide-track system at sidelites.

6. Controls: Activation and safety devices as indicated below and according to BHMA standards.

    a. Activation Device: Motion sensor mounted on each side of door header to detect pedestrians in activating zone and to open door.

    b. Safety Device: Two photoelectric beams mounted in sidelite jambs on each side of door to detect pedestrians in presence zone and to prevent door from closing.
    c. Safety Device: Presence sensor mounted to underside of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing.
    d. Safety Device: Presence sensor mounted on each side of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing.

e. Opening-Width Control: Two-position switch that in the normal position allows sliding doors to travel to full opening width and in the alternate position reduces opening to a selected partial opening width.

7. Finish: Finish framing, door(s), and header with Class II, clear anodic finish.

2.4 ENTRANCE COMPONENTS

A. Framing Members: Extruded aluminum, minimum 0.125 inch thick and reinforced as required to support imposed loads.

1. Nominal Size: 1-3/4 by 4 ½ inch jambs, match adjacent aluminum curtain-walls framing finish.
2. Extruded Glazing Stops and Applied Trim: Minimum 0.062-inch wall thickness.

B. Sidelite(s): 1-3/4-inch deep sidelite(s) with minimum 0.125-inch thick, extruded-aluminum tubular stile and rail members matching door design.

1. Glazing Stops and Gaskets: Same materials and design as for all-glass door.

C. Headers: Fabricated from minimum 0.125-inch thick extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide 6 inch wide by 8 inch high hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

1. Mounting: Concealed, with one side of header flush with framing.
2. Capacity: Capable of supporting doors up to 175 lb per leaf over spans up to 14 feet without intermediate supports.

a. Provide sag rods for spans exceeding 14 feet.

D. Brackets and Reinforcements: High-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Signage: As required by cited BHMA standard.

1. Application Process: Decals.
2. Provide sign materials with instructions for field application after glazing is installed.

2.5 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B 221.
2. Sheet: ASTM B 209.

B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

C. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

D. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

E. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness, in entrance manufacturer's standard thickness.

F. Glazing: As specified in Division 08 "Glazing."

G. Sealants and Joint Fillers: As specified in Division 07 Section "Joint Sealants."

H. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107/C 1107M; of consistency suitable for application.

I. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

J. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.6 DOOR OPERATORS AND CONTROLS

A. General: Provide operators and controls, which include activation and safety devices, according to BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.

1. Door Operator Performance: Door operators shall open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
2. Electromechanical Operators: Concealed, self-contained, overhead unit powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; UL 325; and with manual operation with power off. Integrate with access control system card readers as specified in Division 08 Section, Door Hardware.

C. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by its plastic housing; adjustable to provide detection-field sizes and functions required by BHMA A156.10.

1. Provide capability for switching between bidirectional and unidirectional detection.

2. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.

D. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection-field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.

E. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.

F. Wireless or Remote Radio Control Switch: Auxiliary radio control system consisting of header-mounted receiver and hand-held, battery-operated transmitter switch for each entrance indicated to have remote control.

G. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.7 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish.

B. Breakaway Device for Power-Operated Doors: Device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be as stipulated in "Performance Requirements" Article. Interrupt powered operation of door operator while in breakaway mode.

C. Deadlocks: Deadbolt operated by exterior cylinder and interior thumb turn, with minimum 1-inch long throw bolt; BHMA A156.5, Grade 1.

1. Cylinders: As specified in Division 08 Section, "Door Hardware."

a. Keying: Integrate into building master key system and/or integrate into access control system.

2. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.

D. Weather Stripping: Replaceable components.

1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.8 FABRICATION

A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

1. Form aluminum shapes before finishing.

2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match framing or fabricated from stainless steel.

    a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
    b. Reinforce members as required to receive fastener threads.

4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.

1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
3. Form profiles that are sharp, straight, and free of defects or deformations.
4. Provide components with concealed fasteners and anchor and connection devices.
5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
6. Fabricate exterior components to drain condensation and water passing joints within system to the exterior.
7. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
8. Allow for thermal expansion of exterior units.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."

F. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.

1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors and breakaway sidelites.

G. Controls:

1. General: Factory install activation and safety devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.
2. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as required by referenced standards and as follows:

a. Top Beam: 48 inches.
b. Bottom Beam: 24 inches.

2.9 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install automatic entrances according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.

1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
4. Level recesses for recessed thresholds using nonshrink grout.

C. Door Operators: Connect door operators to electrical power distribution system.

D. Access-Control Devices: Connect access-control devices to access-control system as specified in Division 8 Section "Door Hardware."

E. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions and cited BHMA standard for direction of pedestrian travel. Connect control wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

F. Glazing: Install ½ inch clear tempered glazing as specified in Division 08 Section “Glazing.”

G. Sealants: Comply with requirements specified in Division 07 Section "Joint Sealants" to provide weathertight installation.

1. Set thresholds/bottom-guide-track system, framing members and flashings in full sealant bed.
2. Seal perimeter of framing members with sealant.

H. Signage: Apply signage on both sides of each door and breakaway sidelites as required by cited BHMA standard for direction of pedestrian travel.

I. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 FIELD QUALITY CONTROL

A. Certified Inspector: Engage a Certified Inspector to test and inspect components, assemblies, and installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.

C. Automatic entrances will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust exterior doors for weathertight closure.

B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

C. Occupancy Adjustments: Provide up to two visits to Project at times requested by Owner, for a period of 12 months following the date of Substantial Completion, to provide on-site assistance in adjusting system to suit actual occupied conditions. On-site assistance shall be at times of Owner’s normal occupancy hours.

3.5 CLEANING

A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.

3.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include **12** months' full maintenance by skilled employees of automatic entrance Installer. Include **monthly** preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
2. Perform maintenance, including emergency callback service, during normal working hours.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION

SECTION 084413
ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes conventionally glazed aluminum curtain walls.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
2. Division 08 Section "Aluminum Framed Entrances and Storefronts" for storefront framing and aluminum entrance doors to be incorporated within Aluminum Curtain Walls.
3. Division 08 Section "Glazing" for curtain wall glazing.
4. Division 08 Section "Sliding Automatic Entrances" for sliding entrance systems to be incorporated within Aluminum Curtain Walls.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. Include details of each type of vertical-to-horizontal intersection of curtain wall framing, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

C. Governing Agency Deferred Approval: Projects under the jurisdiction of the Division of the State Architect (DSA) require the design of window framing members to be reviewed and approved by the Division of the State Architect through a Deferred Approval when the project includes window framing members having spans exceeding 10 feet in length. When a deferred approval is required, the deferred approval submittal shall be applicable to all windows regardless of span. Refer to DSA Interpretive Regulation IR 24-2 for additional information; IR 24-2 is available on DSA's website.

1. Window system Deferred Approval submittal shall include necessary shop drawings, details, and structural calculations prepared, stamped, and signed by a structural engineer licensed in the State of California. The window system supplier or installer shall be responsible for the design and engineering calculations and drawings, and shall be responsible for responding to and resolving any comments from the DSA.
2. The Deferred Approval submittal shall be submitted to the Architect through the General Contractor. The Architect will transmit the Deferred Approval submittal to the Division of the State Architect.

D. Qualification Data: For installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for curtain wall systems, indicating compliance with performance requirements.

F. Field quality-control reports.

G. Sample Warranties: For special warranties.

H. Maintenance Data: For curtain wall systems to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.5 MOCKUPS

A. Mockups: Build mockups to verify compliance with Specifications, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups at location(s) as directed by Architect.

a. At least one mockup shall be required for each different installation condition and shall include head, jamb, and sill conditions.

2. Mockup of curtain wall framing shall be integrated and coordinated with associated weather resisting components including but not limited to weather resistive barriers, exterior wall insulation, flashing, wall finishes.
3. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 COORDINATION

A. Coordinate installation of products specified in this Section with installation of products specified in the following Sections:

1. Division 07 Section “Weather Resistive Barriers.”
2. Division 07 Section “Sheet Metal Flashing and Trim.”
3. Division 09 Section “Gypsum Board.”
4. Division 09 Section “Cement Plastering.”
5. Additional Sections as applicable to products comprising exterior wall finishing materials and/or systems.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of curtain wall systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design curtain wall systems, including comprehensive engineering analysis, using performance requirements and design criteria indicated.

B. General Performance: Comply with performance requirements specified, as determined by testing of curtain wall systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Curtain wall systems shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Glass breakage.
d. Noise or vibration created by wind and thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Failure of operating units.
g. Sealant failure.

C. Structural Design Wind Loads: Curtain wall systems shall be designed to withstand wind loads determined according to ASCE/SEI 7 and the 2022 California Building Code.

1. Wind Loads: As indicated on Drawings and not less than 16 lbf/sq. ft. (Strength Design LRFD), acting inward and outward.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

E. Structural Testing: Curtain wall systems shall comply with testing according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, curtain wall assemblies do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E283 for infiltration as follows:

1. Fixed Framing and Glass Area: Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

G. Water Penetration Under Static Pressure: Test according to ASTM E331; there shall be no evidence water penetration through fixed glazing and framing areas when tested according to minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than of 10 psf.

H. Seismic Performance: Curtain wall assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the 2022 California Building Code.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

I. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed Glazing and Framing Areas: U-factor for the system of not more than .039 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Solar Heat-Gain Coefficient (SHGC): Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.27 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas as a system shall have an NFRC-certified condensation resistance rating of no less than 57 as determined according to NFRC 500.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes of 120 degrees F ambient and 180 degrees F material surface.

2.2 MANUFACTURERS

A. Basis-of-Design Products: In other Part 2 Articles where named manufacturer's products are indicated as "Basis of Design," Design, Drawings and Specifications are based on products manufactured by:

1. Kawneer North America; an Alcoa company.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) EFCO Corporation.
2) Oldcastle Building Envelope.
3) United States Aluminum.

B. Source Limitations: Obtain all components of curtain wall system, including framing and accessories, from a single source from a single manufacturer.

2.3 ALUMINUM CURTAIN WALL SYSTEMS

A. Framing Members: Manufacturer's extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

a. KAWNEER Corporation; Series 1600UT System 2 aluminum curtain wall.

2. Size: 2-1/2 inches by 7-1/2 inches nominal overall depth.
3. Wall Thickness: Not less than 0.080 inches.
4. Construction: Thermally broken.
5. Glazing System: Retained mechanically with gaskets on four sides.
6. Glazing Plane: Front.
7. Glazing Thickness: 1-inch.
8. Finish: Clear anodic finish.
9. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
10. Steel Reinforcement: As required by manufacturer.

B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing; include snap-on aluminum trim that conceals fasteners.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

2.4 GLAZING

A. Glazing: Glazing shall be as specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Glazing Sealants: As recommended by curtain wall system manufacturer.

1. Sealants shall comply with requirements specified in Division 07 Section “Joint Sealants.”
2. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Perimeter Joint Sealants: As recommended by curtain wall system manufacturer.

1. Sealants shall comply with requirements specified in Division 07 Section “Joint Sealants.”
2. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

D. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.6 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

C. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior or exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAM10C21A41, Architectural Class, 0.7 mils minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

I. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

J. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

K. Install glazing as specified in Division 08 Section "Glazing."

L. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

M. Entrance Doors: Install doors specified in other sections to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weatherstripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 ERECTION TOLERANCES

A. Install glazed aluminum curtain walls to comply with the following tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet, 1/2 inch maximum.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Field Quality-Control Testing: Perform the following test on representative areas of curtain wall assemblies as directed by Architect.

1. Testing shall be performed by the Contractor in the presence of the Owner’s Inspector. The Owner’s Inspector shall be responsible for observing and reporting results of testing.
2. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

    a. Perform a minimum of three tests per area at areas as directed by Architect.

B. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

C. Inspection Reports: Inspection reports shall be prepared by the Owner’s Inspector.

END OF SECTION

SECTION 085619

PASS WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Interior, pre-glazed, horizontal sliding aluminum framed pass windows.

1.3 SUBMITTALS

A. Product Data: For each type of product, include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

B. Shop Drawings: For aluminum windows, include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and installation details.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

PART 2 - PRODUCTS

2.1 PASS WINDOWS

A. Pass Window: Interior aluminum framed horizontal sliding pass window with half bottom track (No track at pass thru), factory glazed.

B. Basis-of-Design: Design, Drawings, and Specifications are based on the following:

1. CRL; DW4836OXGA Deluxe Service Window.

a. Subject to compliance with requirements, provide the product indicated or a comparable product subject to Architect’s approval.

C. Pass Window Characteristics:

1. Use Location: Interior.
2. Operation: Manual.
3. Size: 48 inches wide by 36 inches high, nominal.
4. Glazing: 1/4 inch thick clear tempered glass ASTM 1048, factory glazed.
5. Framing: Aluminum extrusions, manufacturer's standard.

    a. Framing Depth: 4 inches.
    b. Sill: Half bottom track at fixed panel, open at sliding panel with no track at pass thru.
    c. Finish: Clear anodized.

6. Latch/Lock: Provide manufacturer's standard latch and optional keyed lock.
7. Seals: Manufacturer's standard.

D. Accessibility Compliance:

1. Sill Height: 34 inches maximum above the floor.
2. Height for Operation of Locks and Latches: 15 inches minimum, 46 inches maximum above the floor.
3. Operational Requirements: Operable parts shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate operable parts shall be 5 lbs maximum.

2.2 FABRICATION

A. Fabricate pass windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Factory-glaze aluminum windows in the factory where practical and possible for applications indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings and conditions with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify rough opening dimensions, levelness of sill plate, squareness of openings, and operational clearances.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing pass windows, hardware and other components.

B. Install pass windows level, plumb, square, true to line, without distortion or impeding movement, anchored securely in place to structural support, and in proper relation to wall and other adjacent construction.

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust pass window for smooth operation and for a tight fit at contact points.

B. Clean exposed surfaces immediately after installing pass windows.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION

SECTION 087100
DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other door types to the extent indicated in the Door Hardware Sets at the end of this section.
4. Testing of egress doors with panic hardware and fire rated door assemblies as required by NFPA 101.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
4. Division 26, 27 and 28 Electrical Sections as applicable for connections to electrical power system, low-voltage wiring, and security systems work for electrified hardware.

1.3 REFERENCES AND ABBREVIATIONS

A. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ADA: Americans with Disabilities Act (ADA), 2010 ADA Standards for Accessible Design.
2. ANSI A117.1, Accessible and Usable Buildings and Facilities.
3. BHMA: Builders' Hardware Manufacturers Association.
4. CCR: California Code of Regulations, Title 24, Part 2, California Building Code.

5. DHI: Door and Hardware Institute.
6. NFPA: National Fire Protection Association.

    a. NFPA 70, National Electrical Code.
    b. NFPA 80, Standard for Fire Doors and Other Opening Protectives.
    c. NFPA 101: Life Safety Code.
    d. NFPA 105: Standard for Smoke Door Assemblies and Other Opening Protectives.
    e. NFPA 252: Standard Methods of Fire Tests of Door Assemblies.

7. UL - Underwriters Laboratories.

    a. UL 10C: Positive Pressure Fire Tests of Door Assemblies.
    b. UL 305: Panic Hardware.

8. SDI: Steel Door Institute.
9. WHI: Warnock Hersey Incorporated.
10. NAAMM: National Association of Architectural Metal Manufacturers.

B. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.4 SUBSTITUTIONS

A. Substitutions: Substitutions will only be allowed by substitution requests submitted in accordance with Division 01 Section “Substitution Procedures” prior to the bid date.

1. In Part 2 Articles and the Hardware Sets listed at the end of this Section where manufacturers are listed for various product types and only one manufacturer is listed with no alternate manufacturers indicated, manufacturer listed is an established Owner standard and substitutions will not be allowed.

1.5 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.
    c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.7 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Door hardware for this project, all of which is to be furnished and installed by the contractor, entails the ASSA Abloy Persona access control system and Medeco eCLIQ electronic locking system. These systems are to be installed by an ASSA Abloy certified integrator. Refer to the ASSA Abloy website or contact an ASSA Abloy sales rep for a list of certified integrators in this region.

F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

G. California Building Code: Provide hardware that complies with CBC Section 11B.

1. All openings as a part of an accessible route shall comply with CBC Section 11B-404.
2. The clear opening width for a door shall be 32” minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34” and 4” maximum projections into it between 34” and 80” above the finish floor or ground. Door closers and stops shall be permitted to be 78” minimum above the finish floor or ground. CBC Section 11B-404.2.3.
3. Operable hardware on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34” minimum and 44” maximum above finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides.
4. Hardware (including panic hardware) shall not be provided with “nightlatch” function for any accessible doors or gates unless the following conditions are met:

    a. Such hardware has a ‘dogging’ feature and is dogged during the time the facility is open.
    b. All ‘dogging’ operation is performed only by employees as their job function (non-public use).

5. The force for pushing or pulling open a door shall be in accordance with CBC Section 11B-404.2.9.

    a. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 pounds (22.2 N) maximum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed 15 pounds (66.7N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
    b. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds (22.2N) maximum to comply with CBC Section 11B-309.4.
    c. The 5 pound (22.2 N) maximum force shall be validated for the size of the door used. The Building Materials Listing of the California State Fire Marshal shall indicate that the door hardware meets the 5 pound (22.2 N) force and shall also list the largest door that can be used.

6. Door closing speed shall comply with CBC Section 11B-404.2.8. Closers shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.
7. Floor stops shall not be located in the path of travel and 4” maximum from walls.
8. Thresholds shall comply with CBC Section 11B-404.2.5.

H. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

I. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

J. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

K. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.8 CONFERENCES AND MEETINGS

A. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings."

1. Conference participants shall include Owner’s lock system representative, Supplier’s Architectural Hardware Consultant, Contractor, and Architect.
2. Incorporate the following criteria into the final keying schedule document:

    a. Function of building, purpose of each area and degree of security required.
    b. Plans for existing and future key system expansion.
    c. Requirements for key control storage and software.
    d. Installation of permanent keys, cylinder cores and software.
    e. Shipping address and requirements for delivery of keys.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings." Attendees shall include Owner, Contractor, Architect, Project Inspector, Installer, and Supplier’s Architectural Hardware Consultant. Review and discuss the following:

1. Methods and procedures for receiving, handling, and installing door hardware.
2. Electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Sequence of operation narratives for each unique access controlled opening.
4. Finalize construction schedule and verify availability of materials.
5. Required inspecting, testing, commissioning, and demonstration procedures.

1.9 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.10 COORDINATION

A. Templates: Furnish hardware templates to the parties involved with factory hardware preparation for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Review, compare, and coordinate scheduled hardware with doors, frames, and adjacent floor and wall conditions for non-compatible mounting and/or operating conditions; notify Architect in writing of any conflicts.

C. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm systems and similar control systems.

D. Aluminum Storefront Entrances: Coordinate hardware for aluminum entrance doors with hardware specified in this Section.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures include excessive deflection, cracking, or breakage.
b. Faulty operation of door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
d. Electrical component defects and failures within the systems operation.

2. Warranty Period: Established from date of final acceptance by Owner:

a. Closers: Thirty (30) years.
b. Exit Devices: Ten (10) years for mechanical features.
c. All other hardware: Two (2) years.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND REGULATORY REQUIREMENTS

A. Regulatory Requirements: Comply with the 2010 ADA Standards for Accessible Design, ANSI A117.1, and the 2022 California Building Code, Chapters 10 and 11B.

Mounting Height and Operation: Operable parts of door hardware for opening doors shall be 34 inches minimum and 44 inches above the floor. Hand-activated door opening hardware shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist to operate; the force required to activate operable parts shall not exceed 5 lbs. Egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort. The unlatching of any door or leaf shall not require more than one operation (CBC 11B-309.4 & 11B-404.2.7, 1010.2.1, 1010.2.3).

1. Closers, Opening Force: The opening force shall be the push/pull effort applied perpendicular to the face of the door at the operating hardware. Other than

required fire rated doors, the effort to operate doors shall not exceed 5 pounds; the effort to operate required fire rated doors shall be the minimum force allowable by the appropriate administrative authority and shall not exceed 15 pounds (CBC 11B-404.2.9).

2. Closers, Closing Sweep Period: The closing sweep period for doors shall be such that from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch (CBC 11B-404.2.8.1).
3. Thresholds: The height differential between the tops of thresholds and adjacent floor or landing surfaces shall not be more than 1/2 inch; vertical offsets exceeding 1/4 inch shall be beveled with a 2:1 (horizontal to vertical) maximum slope (CBC 11B-404.2.5).
4. Bottom Door Surface: The bottom 10 inches of swinging doors shall have a smooth surface on the push side extending the full width of the door or gate; parts creating horizontal or vertical joints in these surfaces shall be within 1/16 inch of the same plane as the other and be free of sharp or abrasive edges; cavities created by added kick plates shall be capped (CBC 11B-404.2.10).

B. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C. Provide proper latching hardware, door closers, approved-bearing hinges, and seals whether listed in the Hardware Schedule or not.

1. Where exit devices are indicated on fire-rated door assemblies, provide UL label on exit devices indicating "Fire Exit Hardware".

C. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 MATERIALS

A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.3 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

    a. Two Hinges: For doors with heights up to 60 inches.
    b. Three Hinges: For doors with heights 61 to 90 inches.
    c. Four Hinges: For doors with heights 91 to 120 inches.

d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.4 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:.

a. Pemko (PE).

2.5 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. McKinney (MK) - QC (# wires) Option.

B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. Pemko (PE) - EL-CEPT Series.
    b. Securitron (SU) - EL-CEPT Series.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. McKinney (MK) - QC-C Series.

2.6 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

a. Rockwood (RO).

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

a. Rockwood (RO).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:

a. Rockwood (RO).

2.7 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

E. Construction Keying: Provide construction master keyed cylinders.

2.8 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 8200 Series.

2.9 CYLINDRICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Electromechanical locksets shall have the following functions and features:

a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
c. Options to be available for request-to-exit or enter signaling.
d. Two-year limited warranty on electrified functions.

2. Manufacturers:

a. Sargent Manufacturing (SA) - 10X Line.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:

a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
c. No catch points: addition of applied deflectors or other added components are not allowed.
d. No visible plastic.
e. Heavy duty end caps with flush and overlapping options made of stainless steel, brass, or bronze with architectural finishes.
f. Constructed of all stainless steel.
g. Stainless steel pullman type latch with deadlock feature.
h. Narrow or wide style exterior trim as specified in the hardware sets.
i. Center case adjustability on concealed vertical rod exit devices; single operation with hex key individually adjusts top or bottom latches. No retainer screws or clips required to maintain adjustment.
j. Ten-year limited warranty for mechanical features.

2. Manufacturers:

a. Sargent Manufacturing (SA) - PE80 Series.

2.12 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

a. Norton Rixson (NO) - 7500 Series.
b. Sargent Manufacturing (SA) - 351 Series.

C. Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, high efficiency door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.

1. Manufacturers:

a. Norton Rixson (NO) - 2800ST Series.
b. Sargent Manufacturing (SA) - 422 Series.

2.13 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do

not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. Rockwood (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

    a. Norton Rixson (RF).
    b. Rockwood (RO).
    c. Sargent Manufacturing (SA).

2.14 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2. ELECTRONIC ACCESSORIES

G. Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.

a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
b. Tolerates brownout or overvoltage input ± 15% of nominal voltage.
c. Thermal shutdown protection with auto restart.
d. Circuit breaker protection against overcurrent and reverse battery faults.
e. Integrated battery charging circuit to prevent overvoltage on locking devices.
f. Available with a single relay fire trigger or individually triggered relayed outputs.
g. Monitoring options as specified.

2. Manufacturers:

a. Securitron (SU) - AQD Series.

2.15 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Supplier’s Architectural Hardware Consultant (AHC), with installer present, shall inspect and test installed door hardware operation with the building’s climate control system at rest and in full operation. Architectural Hardware Consultant shall certify that hardware has been furnished and installed in accordance with the Contract Documents, manufacturer's instructions, as specified herein, and that door hardware operates as intended.

C. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.

D. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

E. Prepare and submit separate inspection reports for each fire-rated door assemblies and egress door assemblies indicating compliance with each item listed in NFPA 80 and NFPA 101, Section 7.2.1.15.6.

F. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

G. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.5 ADJUSTING

A. Initial Adjustment: Approximately 2 weeks prior to completion or occupancy, check each operating item of door hardware for each door to ensure proper operation or function; adjust operational hardware as needed for proper operation. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Adjust door latches and closers with heating and ventilating equipment fans in operation in order to compensate for room-to-room or room-to-exterior air pressure differences.
2. Door Closers: Adjust door closers so that the effort to operate doors shall not exceed a 5 pound force for non-fire rated doors; the force for fire rated doors shall be the minimum force allowable by the appropriate administrative authority and shall not exceed 15 pounds; the force shall be the push/pull effort applied at right angles to hinged doors (CBC 11B-404.2.9). Adjust the sweep period for closers so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch (CBC 11B-404.2.8.1).

B. Occupancy Adjustment and Service: Approximately six months after the completion of the project, the Contractor, accompanied by the Architectural Hardware Consultant, shall return to the project and check each operating item of door hardware and each door to ensure proper operation or function of every unit; re-adjust hardware items to restore proper functions. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. OT - Other
3. PE - Pemko

4. RO - Rockwood
5. AT - Accurate Lock and Hardware
6. SA - SARGENT
7. RF - Rixson
8. NO - Norton
9. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 100B, 100C

1	Continuous Hinge	CFM_SLF-HD1 EL-CEPTx32D		PE
1	Rim Exit Device	5CH 55 56 PE8504 Less Pull	US32D	SA
1	Cylinder Housing	Schlage FSIC Format		OT
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Pull	RM3311-36" Mtg-Type 12XHD	US32D	RO
1	Door Closer	PR7500	689	NO
1	Drop Plate	As Required	689	NO
1	Door Stop	471 EXP	US26D	RO
1	Gasket	By Door Manufacturer		
1	Sweep	315CN	Al	PE
1	Threshold	Per Detail & Field Conditions x FHSL	Al	PE
1	Frame Harness	QC-C__x (length as required)		MK
1	Door Harness	QC-C__x (length as required)		MK
1	Power Supply	AQDx (size as reqd)		SU
1	Card Reader	By Security Contractor		

Notes: Presenting authorized credential to reader on wall momentarily retracts latchbolt on panic allowing door to be pulled open.
REX switch in panic rail signals access control system of authorized egress.
Free egress at all times via exit device.
During loss of power, door remains locked.

Set: 2.0

Doors: 200A

2	Continuous Hinge	CFM_SLF-HD1		PE
1	Mullion	L980A	US28	SA

1	Rim Exit Device	5CH LD PE8504 Less Pull	US32D	SA
1	Rim Exit Device	5CH LD PE8510 EO	US32D	SA
2	Cylinder Housing	Schlage FSIC Format		OT
2	FSIC Format Core - eCliq	322201 DA	26	MC
2	Electric Strike	9600	630	HS
2	SMART Pac Bridge Rectifier	2005M3		HS
2	ElectroLynx Adaptor	2004M		HS
2	Door Pull	RM3311-36" Mtg-Type 12XHD	US32D	RO
2	Concealed Overhead Stop	1-x36	630	NO
2	Door Closer	7500	689	NO
1	Gasket	By Door Manufacturer		
2	Brush Sweep	18061CNB	Al	PE
1	Threshold	Per Detail & Field Conditions x FHSL	Al	PE
2	Frame Harness	QC-C__x (length as required)		MK
1	Motion Sensor (REX)	XMS		SU
1	Power Supply	AQDx (size as reqd)		SU
1	Card Reader	By Security Contractor		

Notes: Presenting authorized credential to reader on wall releases electric strike allowing door to be opened.
Motion sensor switch signals access control system of authorized egress.
Free egress at all times via exit device.
During loss of power, door remains locked.

Set: 3.0

Doors: 201A

1	Continuous Hinge	CFM_SLF-HD1		PE
1	Rim Exit Device	5CH LD PE8504 Less Pull	US32D	SA
1	Cylinder Housing	Schlage FSIC Format		OT
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Electric Strike	9600	630	HS
1	SMART Pac Bridge Rectifier	2005M3		HS
1	ElectroLynx Adaptor	2004M		HS
1	Door Pull	RM3311-36" Mtg-Type 12XHD	US32D	RO
1	Concealed Overhead Stop	1-x36	630	NO
1	Door Closer	7500	689	NO
1	Gasket	By Door Manufacturer		
1	Brush Sweep	18061CNB	Al	PE
1	Threshold	Per Detail & Field Conditions x	Al	PE

		FHSL		
1	Frame Harness	QC-C__x (length as required)		MK
1	Motion Sensor (REX)	XMS		SU
1	Power Supply	AQDx (size as reqd)		SU
1	Card Reader	By Security Contractor		

Notes: Presenting authorized credential to reader on wall releases electric strike allowing door to be opened.
Motion sensor switch signals access control system of authorized egress.
Free egress at all times via exit device.
During loss of power, door remains locked.

Set: 4.0

Doors: 103A

3	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP	US32D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Rim Exit Device	5CH EA IN220-PE8877 BIPS B NEL (by Div. 28)	US32D	SA
1	Cylinder Housing	Schlage FSIC Format		OT
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Closer	PR7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	471 EXP	US26D	RO
1	Gasketing	S44BL		PE
1	Sweep	315CN	Al	PE
1	Threshold	Per Detail & Field Conditions x FHSL	Al	PE
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Notes: Presenting authorized credential to reader on door momentarily unlocks outside lever, allowing door to be opened.
REX switch in push bar signals the access control system of authorized exit.
Free egress at all times via the inside lever.

Set: 5.0

Doors: 132A

4	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP	US32D	MK

2	Electric Hinge	T4A3386 QCxx	US32D	MK
1	Fail Secure Exit Device	5CH 12 55 MDPE8674 NEL	US32D	SA
1	Concealed Vert Rod Exit	5CH 12 55 MDPE8606 NEL	US32D	SA
1	Cylinder Housing	Schlage FSIC Format		OT
1	FSIC Format Core - eCliq	322201 DA	26	MC
2	Door Closer	PR7500	689	NO
2	Kickplate	K1050 10" High x CSK	US32D	RO
2	Door Stop	471 EXP	US26D	RO
2	Astragal	29324CNB		PE
1	Gasketing	S44BL		PE
2	Sweep	315CN	Al	PE
1	Threshold	Per Detail & Field Conditions x FHSL	Al	PE
2	Frame Harness	QC-C__x (length as required)		MK
2	Door Harness	QC-C__x (length as required)		MK
1	Power Supply	AQDx (size as reqd)		SU
1	Card Reader	By Security Contractor		

Notes: Fail-secure exit device – door normally closed and locked.
Presenting authorized credential to reader on wall momentarily unlocks outside lever, allowing door to be opened.
REX switch in exit device signals the access control system of authorized exit.
Free egress at all times via the exit device.
During loss of power, door remains locked.
Card reader unlocks active leaf. Mechanical key unlocks inactive leaf.

Set: 6.0

Doors: 108A

6	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP	US32D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Auto Flush Bolt Set	2842 / 2942	US32D	RO
1	Dust Proof Strike	570	US26D	RO
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Coordinator	2600 x FB x Mtg Brkts	US28	RO
2	Door Closer	PR7500	689	NO
2	Kickplate	K1050 10" High x CSK	US32D	RO
2	Door Stop	471 EXP	US26D	RO
1	Overlapping Astragal	357SP @ inswing / 43SP @		PE

		outswing		
1	Gasketing	S44BL		PE
2	Sweep	315CN	Al	PE
1	Threshold	Per Detail & Field Conditions x FHSL	Al	PE
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Notes: Presenting authorized credential to reader on door momentarily unlocks outside lever, allowing door to be opened.
REX switch in inside lever signals the access control system of authorized exit.
Free egress at all times via the inside lever.

Set: 7.0

Doors: 109A, 114A

8	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP	US32D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Auto Flush Bolt Set	2842 / 2942	US32D	RO
1	Dust Proof Strike	570	US26D	RO
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Coordinator	2600 x FB x Mtg Brkts	US28	RO
2	Surface Closer, Hold Open	CLP7500R	689	NO
2	Kickplate	K1050 10" High x CSK	US32D	RO
1	Overlapping Astragal	357SP @ inswing / 43SP @ outswing		PE
1	Gasketing	S44BL		PE
2	Sweep	315CN	Al	PE
1	Threshold	Per Detail & Field Conditions x FHSL	Al	PE
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Notes: Presenting authorized credential to reader on door momentarily unlocks outside lever, allowing door to be opened.
REX switch in inside lever signals the access control system of authorized exit.

Free egress at all times via the inside lever.

Set: 8.0

Doors: 101CA

3	Hinge, Full Mortise, Hvy Wt	T4A3386 NRP	US32D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Closer	PR7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	471 EXP	US26D	RO
1	Gasketing	S44BL		PE
1	Sweep	315CN	Al	PE
1	Threshold	Per Detail & Field Conditions x FHSL	Al	PE
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Notes: Presenting authorized credential to reader on door momentarily unlocks outside lever, allowing door to be opened.
REX switch in inside lever signals the access control system of authorized exit.
Free egress at all times via the inside lever.

Set: 9.0

Doors: 138A, 138B

1	Continuous Hinge	CFM_SLF-HD1		PE
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	Cylinder Housing	Schlage FSIC Format		OT
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Closer	PR7500	689	NO
1	Door Stop	409 / 441H	US32D	RO
1	Gasket	By Door Manufacturer		
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK

1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Notes: Presenting authorized credential to reader on door momentarily unlocks outside lever, allowing door to be opened.
REX switch in inside lever signals the access control system of authorized exit.
Free egress at all times via the inside lever.

Set: 10.0

Doors: 101A

2	Continuous Hinge	CFM_SLF-HD1 EL-CEPTx32D		PE
1	Concealed Vert Rod Exit	5CH 55 56 ADPE8410 P106	US32D	SA
1	Concealed Vert Rod Exit	5CH 55 56 ADPE8410	US32D	SA
1	Cylinder Housing	Schlage FSIC Format		OT
1	FSIC Format Core - eCliq	322201 DA	26	MC
2	Door Pull	RM3311-36" Mtg-Type 12XHD	US32D	RO
2	Surface Closer, Hold Open	CLP7500R	689	NO
2	Door Stop	409 / 441H	US32D	RO
1	Gasket	By Door Manufacturer		
2	Frame Harness	QC-C__x (length as required)		MK
2	Door Harness	QC-C__x (length as required)		MK
1	Power Supply	AQDx (size as reqd)		SU
1	Card Reader	By Security Contractor		

Set: 11.0

Doors: 101B

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Rim Exit Device	5CH EA IN220-PE8877 BIPS B NEL (by Div. 28)	US32D	SA
1	Cylinder Housing	Schlage FSIC Format		OT
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK

1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 12.0

Doors: 111A, 112A, 134A, 139A, 202A, 202F, 207H, 207K, 209F, 209G, 210BA, 210BB, 210BC, 210F, 215A, 217D

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Notes: Presenting authorized credential to reader on door momentarily unlocks outside lever, allowing door to be opened.
REX switch in inside lever signals the access control system of authorized exit.
Free egress at all times via the inside lever.

Set: 13.0

Doors: 106A, 210A

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Surface Closer	CPS7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Gasketing	S442BL		PE
1	Gasketing	ACP112BL/2		PE
1	Auto Door Bottom	420APKL		PE
1	Threshold	151A		PE

1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Notes: Presenting authorized credential to reader on door momentarily unlocks outside lever, allowing door to be opened.
REX switch in inside lever signals the access control system of authorized exit.
Free egress at all times via the inside lever.

Set: 14.0

Doors: 207B, 212A

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 15.0

Doors: 115A, 208A, 216A

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated		OT

w/Lock/Panic

Set: 16.0

Doors: 117B

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Surface Closer	CPS7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Gasketing	S44BL		PE
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 17.0

Doors: 101AA, 101BA, 202AA, 202B, 202D, 202E, 207A, 207D, 207E, 207F, 207G, 209A, 209B, 209C, 209D, 209E, 217A, 217B, 217C

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Stop	409 / 441H	US32D	RO
1	Gasket	By Frame Manufacturer		OT
1	Door Bottom	STC411APK		PE
1	Threshold	151A		PE
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 18.0

Doors: 123A, 123B

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU

1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
1	Gasketing	S442BL		PE
1	Gasketing	ACP112BL/2		PE
1	Auto Door Bottom	420APKL		PE
1	Threshold	151A		PE
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 20.0

Doors: 125A, 125B

6	Hinge (heavy weight)	T4A3786	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Auto Flush Bolt Set	2842 / 2942	US32D	RO
1	Dust Proof Strike	570	US26D	RO
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Coordinator	2600 x FB x Mtg Brkts	US28	RO
2	Surface Closer, Hold Open	CLP7500R	689	NO
2	Kickplate	K1050 10" High x CSK	US32D	RO
2	Silencer	608		RO
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 21.0

Doors: 124A

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA

Set: 29.0

Doors: 104A, 105A, 204A, 205A

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Push Pull Set	110x73C/73CL	US32D	RO
1	Surface Closer	(PS) 2800ST	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Mop Plate	K1050 4" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO

Set: 30.0

Doors: 100A, 100D, 101CB, 138C, SG119, SG120, SG121, SG122, SG134

1	All Hardware	By Door Manufacturer

END OF SECTION

1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Concealed Overhead Stop	1-x36	630	NO
3	Silencer	608		RO
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 22.0

Doors: 101CD

6	Hinge (heavy weight)	T4A3786	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Auto Flush Bolt Set	2842 / 2942	US32D	RO
1	Dust Proof Strike	570	US26D	RO
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
2	Surface Closer, Hold Open	CLP7500R	689	NO
2	Kickplate	K1050 10" High x CSK	US32D	RO
2	Door Stop	409 / 441H	US32D	RO
2	Silencer	608		RO
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 24.0

Doors: 117A

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
1	Gasketing	S44BL		PE
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK

1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 25.0

Doors: 211A, 211B

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
1	Gasket	By Frame Manufacturer		OT
1	Door Bottom	STC411APK		PE
1	Threshold	151A		PE
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 26.0

Doors: 134B

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Electric Power Transfer	CEPT-C5E	630	SU
1	Access Control Cyl Lock	SF IN220-10XG77 BIPS B LL (by Div. 28)	US26D	SA
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Concealed Overhead Stop	1-x36	630	NO
1	Door Closer	7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
3	Silencer	608		RO
1	ElectroLynx Door Harness	PoE-C__RJ (length as required)		MK
1	ElectroLynx Frame Harness	PoE-C__RJ (length as required)		MK
1	Card Reader	On Door / Integrated w/Lock/Panic		OT

Set: 27.0

Doors: 107A, 116A, 135A, 136A, 137A, 140A, 213A, 214A

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Keyed Privacy Lock	LB V21 8225 LNL	US26D	SA
1	Cylinder Housing	Schlage FSIC Format		OT
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Surface Closer	(PS) 2800ST	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Mop Plate	K1050 4" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO

Set: 28.0

Doors: 206A

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Keyed Privacy Lock	LB V21 8225 LNL	US26D	SA
1	Cylinder Housing	Schlage FSIC Format		OT
1	FSIC Format Core - eCliq	322201 DA	26	MC
1	Surface Closer	CPS7500	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
3	Silencer	608		RO

Set: 29.0

Doors: 104A, 105A, 204A, 205A

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Push Plate	70C	US32D	RO
1	Pull Plate	107x70C	US32D	RO
1	Surface Closer	(PS) 2800ST	689	NO
1	Kickplate	K1050 10" High x CSK	US32D	RO
1	Mop Plate	K1050 4" High x CSK	US32D	RO
1	Door Stop	409 / 441H	US32D	RO
3	Silencer	608		RO

Set: 30.0

Doors: 101CB, 120A, 138C, SG119, SG120, SG121, SG122, SG134

1	All Hardware	By Door Manufacturer

Set: 31.0

Doors: MISC EXTRA

100	FSIC Format Core - eCliq	322201 DA	26	MC
1	eCliq Remote Programming Device	EA-100298		MC
300	eCliq Connect Keys	EA-100270-100		MC

Set: 32.0

Doors: 100A, 100D

1	Card Reader	By Security Contractor
1	All Hardware	By Door Manufacturer

END OF SECTION 087100

SECTION 088000

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Glass for windows, doors, storefront framing, curtain wall framing and sloped glazing framing.

a. Glass Types are indicated in door and window schedules on drawings and in glass type schedules at the end of this Section. Provide glass units that comply with door opening STC sound rating indicated in Division 08 door and frame sections.

2. Glazing sealants and accessories.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 SUBMITTALS

A. Product Data: For each type of product; include statement of VOC content for any adhesives or sealants.

B. Glass Samples: For each type of glass product, other than clear monolithic glass, in 12-inch square samples for the following:

1. Tinted glass and colored glass.
2. Coated glass (low -e).
3. Laminated glass.
4. Insulating glass vision units.

a. Vertical wall glass units.

5. Obscure glass.
6. Spandrell: Insulating glass units.

C. Glazing Accessory Samples: For sealants and colored spacers in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system, including structural silicon sealants.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in installations with a record of successful in-service performance; and who employs glass installers for this Project who are experienced in installing glazing similar in material, design, and extent to that indicated for this Project.

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

1.6 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: Where products are identified by manufacturer and product names, Design, Drawings, and Specifications are based on the product indicated; subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Basis of design Manufacturer: Vitro Architecutural Glass for solarban 90 coating and starphire vision glass.
2. Subject to compliance with requirements, provide products by specified manufacturer or comparable products by one of the following subject to request for substitution and approval prior to bid:
   a. Guardian Industries.
   b. Oldcastle Building Envelope.
   c. Pilkington Building Products North America.
   d. Viracon, Inc.

B. Source Limitations for Glass: Obtain glass from a single source from a single manufacturer for each glass type.

1. Obtain tinted glass from a single source from a single manufacturer.
2. Obtain reflective-coated glass from a single source from a single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain accessories from a single source from a single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. California Code of Regulations, Title 24, Part 6, California Energy Code.

1. NFRC 100: Procedure for Determining Fenestration Product U-factors."
2. NFRC 200 Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence."
3. NFRC 400: Procedure for Determining Fenestration Product Air Leakage."

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the California Building Code and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publication: "Glazing Manual."
2. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Identification: Where safety glazing is indicated, each pane of safety glazing shall be identified by a manufacturer's designation specifying who applied the designation, the manufacturer or installer and the safety glazing standard with which it complies, as well as the information specified in CBC Section 2403.1. The designation shall be acid etched, sand blasted, ceramic fired, laser etched, embossed, or of a type that once applied cannot be removed without being destroyed. A label meeting the requirements of CBC Section 2406.3 shall be permitted in lieu of the manufacturer's designation.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated to include STC sound ratings as indicated on door and window schedules.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3.

B. Ultraclear Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.

1. Basis of Design: Vitro Starphire for exterior envelope vision glass.

C. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

E. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

F. Reflective-Coated Vision Glass: ASTM C 1376 with Vitro Solarban 90 coating.

G. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3 with ICD OPACI-COAT color 3-0770, warm gray.

H. Reflective-Coated Spandrel Glass: ASTM C1376, Kind CS.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements to include assemblies that comply with door and window STC sound ratings indicated on door and window scedules.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary seals.
2. Spacer: Manufacturer's standard spacer material and construction, aluminum with mill or clear anodic finish.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in Part 3 Article "Insulating Glass Schedule."

1. Provide Kind HS (Heat-strengthened) or Kind FT (Fully tempered) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.

2. Provide laminated kind FT (Fully Tempered) float glass at overhead sloped glazing in compliance with applicable overhead glazing safety regulators.

2.7 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. VOC Content: Field applied sealants shall have a VOC content of not more than 250 g/L.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 790.
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. Tremco Incorporated; Spectrem 1.

C. Structural Glazing Sealant: Structural Silicone Sealant as required by framing and insulated glass manufacturers and approved by Division of the State Architect (DSA).

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Type recommended by sealant or glass manufacturer; EPDM, Silicone, Neoprene, or Santoprene; with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Type recommended by sealant or glass manufacturer; neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Type recommended by sealant or glass manufacturer; EPDM, Silicone, Neoprene, or Santoprene; with a Shore A durometer hardness per manufacturer's written instructions.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

    a. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lights.

F. Provide spacers for glass lights where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to

maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until immediately before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lights and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass

manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.8 MONOLITHIC GLASS SCHEDULE

A. Glass Type FTG: Frosted tempered glass.

B. Glass Type G: Clear glass.

C. Glass Type TG: Tempered glass, clear

D. Glass Type TSG: Spandrel glass, tempered.

E. Glass Type xx:

F. Monolithic glass types as follows:

1. Glass Type FTG: Tempered patterned/obscure glass.

    a. Location: Where indicated for interior doors.
    b. Pattern: Submit samples for selection by Architect.
    c. Thickness: 6.0 mm.
    d. Safety glazing required.

2. Glass Type G: Clear float glass.

    a. Location: Interior windows where safety glass is not required, typical.
    b. Thickness: 6.0 mm.

3. Glass Type TG: Clear fully tempered float glass.

    a. Location: xxxx Typical at interior doors and windows adjacent to doors as indicated.
    b. Thickness: 6.0 mm.
    c. Safety glazing required.

4. Glass Type TSG: Reflective coated & ceramic frit coated spandrel glass, fully tempered float glass.

    a. Basis of Design: Vitro Solarban 90 (face 3); ICD OPACI-Coat color warm gray, face 4 where concealed from view, face 3 (in lieu of low-e coating) where face 4 is exposed to view.
    b. Thickness: 6.0 mm.
    c. Safety glazing required.
    d. Factory apply manufacturer's standard opacifier material to coated fourth surface of lites, with resulting products complying with Specification No. 89-1-6 in GANA's Tempering Division's "Engineering Standards Manual":

5. Glass Type CT: Tinted fully tempered float glass.

a. Location: Where indicated to be used with insulating glass units.
b. Thickness: 6.0 mm.
c. Safety glazing required.
d. Tint Color: As indicated under insulated glass unites.

6. Glass Type RG: Reflective coated vision glass, fully tempered float glass. Typical at exterior pane of curtain wall insulated glass units.

a. Basis of Design : Vitro starphire glass.
b. Coating Color: Solarban 90.
c. Thickness: 6.0 mm.
d. Coating Location: Second surface.
e. Safety glazing required.

7. Glass Type LG: Clear Laminated, fully tempered float glass. At door lites, provide thicker glass as required to achieve STC sound rating indicated in Division 08 Door Sections.

a. Basis of Design: Vitro clear glass.
b. Thickness: 6.0 mm minimum.
c. Innerlayer: .060 inch polyvinyl butyral.
d. Safety glazing required.

3.9 INSULATING-GLASS SCHEDULE

A. Glass Type IG: Insulated glass, clear

B. Glass Type SG: Insulated Spandrel glass

C. Glass Type TIG: Insulated glass, clear, tempered.

D. Glass Type TIGB: Insulated glass, tempered, tinted, blue.

E. Glass Type TIGG: Insulated glass, tempered, tinted, green.

F. Glass Type TIGO: Insulated glass, tempered, tinted, orange.

G. Glass Type TIGP: Insulated glass, tempered, tinted, purple.

H. Glass Type TIGR: Insulated glass, tempered, tinted, Red.

I. Glass Type TIGY: Insulated glass, tempered, tinted, Yellow.

J. Glass Type FTIG: Insulated glass, tempered, frosted.

K. xxxxxxx

L. Glass Type TIGX: Low-e coated, tinted, tempered insulating glass units.

1. Overall Unit Thickness: 1-inch (25mm).
2. Minimum Thickness of Each Glass Lite: 6.0 mm.

3. Outdoor Lite: Glass type RG.
   a. Tint Color: xxxxx
   b. Basis of Design: xxxxx
4. Indoor Lite: Vitro starphire (no coating). Type CT where indicated for colored glass.
5. Interspace Content: Clean-Dry-Air.
6. Low-E Coating: On second surface of outdoor lite.
7. Visible transmittance: 54 Percent
8. Winter Nighttime U-Factor: 0.29 maximum.
9. Summer Daytime U-Factor: 0.27 maximum.
10. Solar Heat Gain Coefficient: 0.23.
11. Provide safety glazing labeling.

M. Glass Type xxx IG-1: Low-e coated, clear insulating exterior vision glass units.

1. Overall Unit Thickness: 1-inch (25mm).
2. Minimum Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Glass type RG.
4. Indoor Lite: Vitro starphire (no coating). Type CT where indicated for colored glass.
5. Interspace Content: Clean-Dry-Air.
6. Low-E Coating: On second surface of outdoor lite.
7. Visible transmittance: 54 Percent
8. Winter Nighttime U-Factor: 0.29 maximum.
9. Summer Daytime U-Factor: 0.27 maximum.
10. Solar Heat Gain Coefficient: 0.23.
11. Provide safety glazing labeling.

N. Glass Type TIG IG-2T: Uncoated clear, fully tempered insulating interior glass units.

1. Overall Unit Thickness: 1-inch (25mm).
2. Minimum Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Clear, fully tempered glass type TG.
4. Indoor Lite: Clear, fully tempered glass type TG.
5. Interspace Content: Clean-Dry-Air.
6. Provide safety glazing labeling.

O. Glass Type IG-2N: Uncoated clear non-tempered with Glass.

1. Overall Unit Thickness: 1-inch (25mm).
2. Minimum Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Clear, non-tempered glass type G.
4. Indoor Lite: Clear, non- tempered glass type G.
5. Interspace Content: Clean-Dry-Air.
6. Provide safety glazing labeling.

P. Glass Type IG-3: Low-e coated, clear, fully tempered, Spandrel insulating exterior glass units.

1. Overall Unit Thickness: 1-inch (25mm).
2. Minimum Thickness of Each Glass Lite: 6.0 mm.

3. Outdoor Lite: Glass type RG.
4. Indoor Lite: Clear Glass type SG.
5. Interspace Content: Clean-Dry-Air.
6. Spandrel Coating: ICD ceramic frit on fourth surface.
7. Low-E Coating: Vitro Solarban 90 on second surface.
8. Visible transmittance: 3 percent.
9. Winter Nighttime U-Factor: 0.29 maximum.
10. Summer Daytime U-Factor: 0.27 maximum.
11. Solar Heat Gain Coefficient: 0.17.
12. Provide safety glazing labeling where tempered glass is specified.

3.10 STU'S INSULATING GLASS TYPES

A. Insulated glass types per drawings:

1. Glass Type IG: Insulated glass, clear
2. Glass Type SG: Insulated Spandrel glass
3. Glass Type TIG: Insulated glass, clear, tempered.
4. Colored/tinted glass types:

    a. Glass Type TIGB: Insulated glass, tempered, tinted, blue.
    b. Glass Type TIGG: Insulated glass, tempered, tinted, green.
    c. Glass Type TIGO: Insulated glass, tempered, tinted, orange.
    d. Glass Type TIGP: Insulated glass, tempered, tinted, purple.
    e. Glass Type TIGR: Insulated glass, tempered, tinted, Red.
    f. Glass Type TIGY: Insulated glass, tempered, tinted, Yellow.

5. Glass Type FTIG: Insulated glass, tempered, frosted.

B. Glass Type TIGX: Low-e coated, tinted, tempered insulating glass units.

1. Overall Unit Thickness: 1-inch (25mm).
2. Minimum Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Glass type RG (Reflective coated glass)??????.

    a. Tint Color: xxxxx???? [is glass tinted or coated?]
    b. Basis of Design: xxxxx

4. Indoor Lite: Vitro starphire (no coating). Type CT where indicated for colored glass.
5. Interspace Content: Clean-Dry-Air.
6. Low-E Coating: On second surface of outdoor lite.
7. Visible transmittance: 54 Percent
8. Winter Nighttime U-Factor: 0.29 maximum.
9. Summer Daytime U-Factor: 0.27 maximum.
10. Solar Heat Gain Coefficient: 0.23.
11. Provide safety glazing labeling.

END OF SECTION

SECTION 092116

GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Gypsum board shaft-wall assemblies including metal framing and gypsum board panels at elevator shafts, duct/utility shafts and underside of stairs.

B. Related Sections:

1. Division 05 Section “Cold-Formed Metal Framing.”
2. Division 09 Section “Gypsum Board” for finishing of permanently exposed gypsum board panels.

1.3 SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

B. Evaluation Reports: For shaft wall assemblies and firestop tracks, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures for installing gypsum board shaft-wall assemblies including, but not limited to, the following:

1. Fasteners proposed for anchoring nonstructural steel framing to building structure.
2. Wiring devices in shaft-wall assemblies.
3. Doors and other items penetrating shaft-wall assemblies.
4. Items supported by shaft-wall-assembly framing.
5. Mechanical work enclosed within shaft-wall assemblies.
6. Elevator equipment, including hoistway doors, elevator call buttons, and elevator floor indicators.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

C. Stack panels flat on leveled supports off floor or slab to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install finish panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT-WALL ASSEMBLIES, GENERAL

A. Gypsum Board Shaft Wall Assemblies are tested proprietary fire-resistance-rated design assemblies, acceptable assemblies are scheduled at the end of this Section in Part 3 Article “Gypsum Board Shaft Wall Assembly Schedule.”

B. Acceptable manufacturers shall be limited to manufacturers listed in approved referenced proprietary fire resistance rated shaft wall designs.

C. Fire Resistance Rating: 1-hour.

D. STC Rating: As indicated on Drawings.

2.3 GYPSUM PANEL PRODUCTS

A. Proprietary Products: Acceptable manufacturers shall be limited to manufacturers listed in approved referenced proprietary fire resistance rated shaft wall designs. Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum Company.
2. CertainTeed Gypsum, Inc.
3. Georgia-Pacific Gypsum, LLC.
4. National Gypsum Company.
5. PABCO Gypsum.

B. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

C. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.

1. Thickness: 1 inch thick.
2. Long Edges: Double bevel.

D. Gypsum Board Finish Panels: Type X; ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive wall board panels with paper faces.

1. Thickness: 5/8 inch thick.
2. Long Edges: Tapered.

E. Gypsum Board Cants: ASTM C 1396, 5/8 inch Type X gypsum board as used for finish panels.

2.4 STEEL FRAMING FOR SHAFT WALL ASSEMBLIES

A. Proprietary Products: Acceptable manufacturers shall be limited to manufacturers listed in approved referenced proprietary fire resistance rated shaft wall designs. Subject to compliance with requirements, provide products by one of the following:

a. CEMCO.
b. Clark Dietrich
c. SCAFCO

B. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.

1. Protective Coating: ASTM A 653/A 653M, G40 or G60, hot-dip galvanized unless otherwise indicated.

C. Studs: Manufacturer's standard C-H or C-T stud profile as required by referenced fire resistive design.

1. Depth: As indicated on drawings.
2. Minimum Base-Metal Thickness: As indicated on Drawings, 0.03 inch (20 gauge) minimum.

D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, minimum 2 inches long, and matching studs in depth to include the integral T-shaped flange for the shaft liner board.

1. Minimum Base-Metal Thickness: Matching steel studs.

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Provide firestop top track as manufactured by steel framing manufacturer or as recommended in writing by steel stud manufacturer.
2. Tracks shall be approved for use in the referenced proprietary fire resistance rated shaft wall design.

F. Elevator-Hoistway-Entrance Struts: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches, matching studs in depth, and not less than 0.033 inch thick.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with shaft-wall assembly manufacturer's written instructions.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section “Gypsum Board" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

C. Gypsum Board Joint-Treatment Materials: As specified in Division 09 Section "Gypsum Board."

D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

E. Track Fasteners: Power-driven fasteners as indicated on Drawings.

F. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).

G. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum face-layer panels to backing-layer panels in multilayer construction.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Sound Attenuation Blankets: As specified in Division 07 Section “Thermal Insulation.”

I. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. VOV Content: Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.

B. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.

1. Reinforcing: Provide reinforcing as indicated on Drawings where items attach directly to shaft wall assembly; accurately position and secure reinforcing behind at least one layer of face panel.

2. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.

C. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

D. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

E. Firestop Tracks: Install to maintain continuity of fire-resistance-rated assembly indicated.

F. Control Joints: Install control joints according to ASTM C 840, and in specific locations approved by Architect, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.

G. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 FINISHING OF GYPSUM BOARD

A. Finish permanently exposed to view gypsum board panels as specified in Division 09 Section Gypsum Board.

3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.5 SCHEDULE OF GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Provide one of the following proprietary Gypsum Board Shaft Wall Assemblies listed below.

<u>SW-1: GA File No. WP 6800 (PABCO Gypsum):</u>

SHAFT WALLS

GA FILE NO. WP 6800	PROPRIETARY*	1 HOUR FIRE	45 to 49 STC SOUND

GYPSUM WALLBOARD, STEEL C-T STUDS

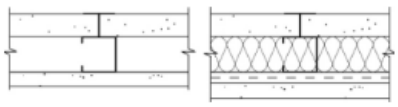
Fire Design:

One layer 1" x 24" proprietary type X gypsum panels inserted between 2-1/2" floor and ceiling runners with T section of 2-1/2" steel C-T studs between panels.

OPPOSITE SIDE: **One** layer 5/8" proprietary type X gypsum wallboard applied parallel to studs with 1" Type S screws 12" o.c. **(NLB)**

Sound Design:

Sound tested with resilient channels 24" o.c. and 2-1/2" glass fiber friction fit in stud space.



Thickness: 3-1/8" (Fire and Sound)
Approx. Weight: 7 psf (Fire and Sound)
Fire Test: WHI-495-1303, 7-19-95
Sound Test: RAL TL96-28, 2-13-96

PROPRIETARY GYPSUM BOARD

PABCO® Gypsum .....5/8" FLAME CURB® Super C Type C
1" PABCORE® Gypsum Liner Board

SW-2: GA File No. WP 6801 (American Gypsum Company, LLC):

SHAFT WALLS

GA FILE NO. WP 6801	PROPRIETARY*	1 HOUR FIRE	45 to 49 STC SOUND

GYPSUM WALLBOARD, STEEL I, C-H, OR C-T STUDS

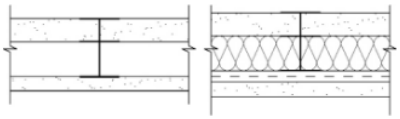
Fire Design:

One layer 1" x 24" proprietary type X gypsum panels inserted between 2-1/2" floor and ceiling J runners with tab-flange section of 2-1/2" steel I, C-H, or C-T stud between panels.

OPPOSITE SIDE: **One** layer 5/8" proprietary type X gypsum wallboard applied parallel to studs with 1" Type S screws 12" o.c. **(NLB)**

Sound Design:

Sound tested with resilient channels 24" o.c. and 2-3/4" glass fiber insulation friction fit in stud space.



Thickness: 3-1/8" (Fire and Sound)
Approx. Weight: 7 psf (Fire and Sound)
Fire Test: UL R14196, 11CA55048, 11-21-11; 4786435000, 5-23-14
UL Design V455, System A; UL Design V433, System C
Sound Test: RAL TL14-253, 7-14-14

PROPRIETARY GYPSUM BOARD

American Gypsum Company LLC .....5/8" FireBloc® Type X Gypsum Board
1" M-Glass® Shaft Liner Panel

SW-3: GA File No. WP 6802 (CertainTeed Gypsum, Inc):

SHAFT WALLS

GA FILE NO. WP 6802	PROPRIETARY*	1 HOUR FIRE	45 to 49 STC SOUND

GYPSUM WALLBOARD, STEEL C-T STUDS

Fire Design:

One layer 1" x 24" proprietary type X gypsum liner panels applied parallel to 2-1/2" Steel C-H, C-T or I studs oriented vertically and free edge of panels attached to the long leg of J-runners with 1-5/8" Type S screws 12" o.c.

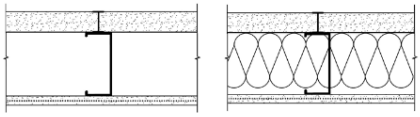
OPPOSITE SIDE: **One** layer 5/8" proprietary type X gypsum wallboard applied parallel to studs with 1" Type S screws 12" o.c. **(NLB)**

Sound Design:

Sound tested with C-T studs and 1-1/2" glass fiber insulation friction fit in stud space.

PROPRIETARY GYPSUM BOARD

CertainTeed Gypsum Inc ..... 1" GlasRoc® Shaftliner Gypsum Panels
5/8" SilentFX® QuickCut™



Thickness:	3-1/8" (Fire and Sound)
Approx. Weight:	7.5 psf (Fire and Sound)
Fire Test:	UL R3660 07NK16263, 11-1-07 07NK22992, 2-18-08 UL Design U417 System F
Sound Test:	NOAL 17-1140, 11-30-17

SW-4: GA File No. WP 6851 (Georgia Pacific Gypsum, LLC.):

SHAFT WALLS

GA FILE NO. WP 6851	PROPRIETARY*	1 HOUR FIRE	40 to 44 STC SOUND

GYPSUM WALLBOARD, STEEL C-H or C-T STUDS

Fire Design:

One layer 1" x 24" proprietary type X gypsum panels inserted between 2-1/2" floor and ceiling J runners with H section of 2-1/2" proprietary C-H or C-T steel studs between panels.

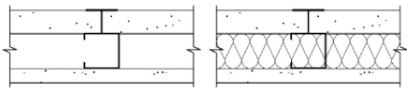
OPPOSITE SIDE: **One** layer 5/8" proprietary type X gypsum wallboard applied parallel or at right angles to studs with 1" Type S screws 8" o.c. **(NLB)**

Sound Design:

Sound tested with 1-1/2" glass fiber insulation friction fit in stud cavity and with the 5/8" proprietary type X gypsum wallboard applied with screws spaced 12" o.c.

PROPRIETARY GYPSUM BOARD

Georgia-Pacific Gypsum LLC .....5/8" ToughRock® Fireguard X® Gypsum Board
1" DensGlass® Shaftliner



Thickness:	3-1/8" (Fire and Sound)
Approx. Weight:	7 psf (Fire and Sound)
Fire Test:	UL R2717, 10CA13714, 7-8-10, UL Design V473
Sound Test:	RAL TL09-357, 12-7-09

SW-5: GA File No. WP 6905 (National Gypsum Co.):

SHAFT WALLS

GA FILE NO. WP 6905	PROPRIETARY*	1 HOUR FIRE	40 to 44 STC SOUND

GYPSUM WALLBOARD, STEEL C-H, C-T, OR I STUDS

Fire Design:

One layer 1" x 24" proprietary type X gypsum panels inserted between 2-1/2" floor and ceiling J runners with tab-flange section of 2-1/2" steel C-H, C-T, or I studs between panels.

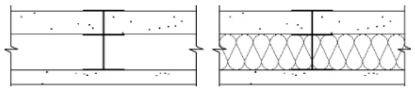
OPPOSITE SIDE: **One** layer 5/8" proprietary type X gypsum wallboard or gypsum veneer base applied parallel or at right angles to studs with 1" Type S screws 12" o.c. **(NLB)**

Sound Design:

Sound tested with 1-1/2" glass fiber insulation friction fit in stud space.

PROPRIETARY GYPSUM BOARD

National Gypsum Company.....5/8" Gold Bond® Brand FIRE-SHIELD® Gypsum Wallboard
1" Gold Bond® Brand FIRE-SHIELD® Shaftliner



Thickness: 3-1/8" (Fire and Sound)
Approx. Weight: 7 psf (Fire and Sound)
Fire Test: UL R3501, 93NK22748, 9-15-93; 97NK24041, 7-14-97; UL Design U499; 13NK02062, 1-14-13, UL Design W419, System A; FM WP-755, 2-27-85
Sound Test: NGC 2016033-R1, 4-21-16

END OF SECTION

SECTION 092400

PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior portland cement plasterwork (stucco) with acrylic finish, including lath and accessories installed over rigid foam board insulation over gypsum sheathing over metal stud framing. Portland cement plastering system to be as described by plaster wall assembly PWA 104 in the “Energy Code and Plaster Assemblies” brochure published by the Technical Services Information Bureau (TSIB), the Northwest Wall and Ceiling Bureau (NWCB), and the Wall and Ceiling Bureau (WCB); cement plastering system includes the following:

    a. Lath.
    b. Cement plaster scratch and brown coats.
    c. Lamina base coat of acrylic modified cement skim coat embedded in fiber mesh applied over the cement plaster brown coat.
    d. Acrylic finish coat.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for exterior steel studs and joists that support lath and portland cement plaster.
2. Division 06 Section "Exterior Gypsum Sheathing" for exterior gypsum sheathing installed over metal stud framing.
3. Division 07 Section "Blanket Insulation" for thermal insulations and vapor retarders included in stud cavities of exterior wall assemblies.
4. Division 07 Section "Weather Resistive Barriers" for building wrap and flexible flashing included in portland cement plaster assemblies.
5. Division 07 Section “Thermal Foam Plastic Wall Insulation” for foam plastic board insulation that is a wall substrate for cement plastering.
6. Division 07 Section “Sheet Metal Flashing and Trim” for sheet metal items installed in conjunction with cement plaster assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated or included in the Work.

B. Samples for Initial Selection: For each type and color of factory-prepared finish coat indicated.

C. Samples for Verification: For each texture and color of finish coat indicated; 36 by 36 inch sample prepared on rigid backing.

D. Research/Evaluation Reports: From ICC-ES or IAPMO ES, for metal lath.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups of area directed by Architect to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Mockups shall include and demonstrate the installation and/or finish of the following:

    a. Weather resistive barrier and flexible flashing at door and window openings.
    b. Sheet metal flashing and trim at door and window openings.
    c. Lath and accessories.
    d. Terminations and transitions to other surfaces and materials.
    e. Cement plastering.

2. Contractor shall coordinate mockups requiring multiple trades.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Owner’s Project Inspector, Architect, and installers whose work interfaces with or affects exterior wall systems, work trades include but are not limited to the following:

    a. Wall Framing.
    b. Wall sheathing.
    c. Weather resistive barriers.
    d. Rigid wall insulation.
    e. Flashing.
    f. Portland cement plastering.

2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review and coordinate installation requirements and installation schedule for each trade.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.7 COORDINATION

A. Coordinate plaster work with work of the following Sections:

1. Division 05 Section "Cold-Formed Metal Framing".
2. Division 06 Section "Exterior Gypsum Sheathing".
3. Division 07 Section "Weather Resistive Barriers".
4. Division 07 Section “Thermal Foam Plastic Wall Insulation”.
5. Division 07 Section “Sheet Metal Flashing and Trim”.
6. Division 08 Sections as applicable to door and window openings adjacent to cement plaster work.

1.8 FIELD CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F.
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with requirements of the California Building Code, Chapter 25, as applicable to lath and cement plaster.

1. Comply with Division of the State Architect (DSA) Interpretive Regulation IR 25-4 for installation of self-furring lath.

2.2 METAL LATH

A. Basis of Design: Where Basis of Design named manufacturer products are indicated, Design, Drawings, and Specifications are based on products by the following:

1. The Structa Wire Corporation.

a. Subject to compliance with requirements, provide products indicated or submit request for substitution per Division 01 Section “Substitution Procedures.”

B. Welded Wire-Fabric Lath for Walls:

1. Basis of Design: Design and details are based on the following:

a. Structa Wire Corporation; Megalath (IAPMO UES ER 2017).

2. Self-furred welded wire fabric lath without paper backing and as follows for use over solid sheathed vertical surfaces.

a. Size: 30 inch by 108 ft. roll.
b. Wire Spacing: 1.5 inch by 0.7 rectangular grid.
c. Wire: Hot-dipped galvanized, low-carbon, cold-drawn steel wire complying with ASTM A641-2, Class 1.

1) Longitudinal (Horizontal) Wires: Wire flattened to dimensions of 0.033 inches by 0.075 inches by cold rolling.
2) Cross (Vertical) Wires: 0.56 inch diameter wire having 1/4 inch high furring crimps spaced 2.125 inches on center.

d. Welding: Each intersection of longitudinal and cross wires shall be electrical resistance welded.
e. Self-Furring: 1/4 inch minimum.
f. Nominal weight of Lath: 1.95 lb/sq. yd.

C. Welded Wire-Fabric Lath for Ceilings:

1. Basis of Design: Design and details are based on the following:

a. Structa Wire Corporation; VTruss Ceiling Lath (IAPMO UES ER 2017).

2. Self-furred welded wire fabric lath sheets with vented kraft paper backing and as follows for use over horizontal surfaces.

a. Sheet Size: 97.5 inches by 28.375 inches.
b. Wire Spacing: 1.5 inch by 0.7 inch rectangular grid.
c. Wire: Hot-dipped galvanized, low-carbon, cold-drawn steel wire complying with ASTM A641-2, Class 1.

1) Longitudinal (Horizontal) Wires: Wire flattened to dimensions of 0.033 inches by 0.064 inches by cold rolling.

2) Cross Wires: 0.05 inch diameter with 3/8 inch high furring crimps spaced 1.9 inches on center.
3) Backing Wires: Coated diameter of 0.050 inch in a longitudinal direction to the furring crimps.

d. Welding: Each intersection of longitudinal and cross wires shall be electrical resistance welded.
e. Self-Furring: 3/8 inch minimum.
f. Nominal weight of Lath: 2.2 lb/sq. yd.
g. Paper Backing: Perforated kraft paper.

D. Corner Reinforcement:

1. Basis of Design: Design and details are based on the following:

a. Structa Wire Corporation; VTruss Straight Corner (IAPMO UES ER 2017).

2.3 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
b. CEMCO.
c. Clark Dietrich Building Systems.
d. MarinoWARE.
e. Stockton Products.

2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 zinc coating.
3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating; use at inside corners.
4. Cornerbeads: Small nose cornerbead with expanded flanges fabricated from zinc-coated (galvanized) steel; use at external corners unless otherwise indicated.
5. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
6. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
8. Two-Piece Expansion Joints: Fabricated from zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch wide; with perforated flanges.

9. Reveals: Fabricated from zinc-coated (galvanized) steel of configuration indicated on Drawings.

C. Aluminum Trim: Extruded aluminum trim accessories of profiles and dimensions indicated on Drawings.

1. Basis of Design: Design and details are based on products manufactured by:

a. The Fry Reglet Corporation.

1) Subject to compliance with requirements, provide products indicated or equivalent products by one of the following:

a) Gordon, Inc.
b) Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Class II clear anodic finish.

2.4 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.

C. Fasteners for Attaching Metal Lath to Framing: Steel drill screws complying with ASTM C 1002 or ASTM C 954, as follows:

1. Fasteners for Metal Framing: 7/16 inch diameter wafer head, shank diameter not less than 0.120 inches, self-drilling point, length as required to penetrate metal framing member by not less than three exposed threads.

D. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.

E. Building Wrap: As specified in Division 07 Section “Weather Resistive Barriers.”

F. Paper Backing: FS UU-B-790, Type I, 60 minute Grade D, Style 2 vapor-permeable paper.

1. Paper backing may be attached to lath or separate from lath.

G. Bonding Compound: ASTM C 932.

2.5 PLASTER MATERIALS

A. Portland Cement: ASTM C 150, Type I.

B. Plastic Cement: ASTM C1328.

C. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

D. Sand Aggregate: ASTM C 897.

E. Reinforcing Mesh: Alkali resistant glass fiber reinforcing mesh, 4 oz. to 6 oz./sq. yd.

F. Polymer cement (Lamina skim coat).

G. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.

1. Basis of Design: Design, Drawings, and Specifications are based on the following:

a. Parex, Inc., E-Lastic.

1) Products: Subject to compliance with requirements, provide one of the following:

a) Dryvit Systems, Inc.; Dryvit TAFS.
b) El Rey Stucco Company, Inc., a brand of ParexLaHabra, Inc.; Prema-Flex.
c) LaHabra, a brand of ParexLaHabra, Inc.; Acrylic Finish.
d) Omega Products International, Inc.; Omega Flex Finishes.
e) Senergy, BASF Wall Systems, Inc.; Senerflex.
f) Sto Corp.; Powerwall Finish.
g) Surewall, a brand of ParexLaHabra, Inc.; Acrylic Finish.
h) SonoWall, BASF Wall Systems, Inc.; StuccoTex Finish.

2. Color: As selected by Architect from manufacturer's full range.

2.6 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.

B. Base Coat Mixes:

1. Scratch and brown coats for three-coat plasterwork for use over metal lath:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime; use 2-1/2 to 4 parts sand per part of cementitious material.
b. Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime; use 3 to 5 parts sand per part of cementitious material, but not less than the volume of sand used in the scratch coat.

C. Polymer Cement (Lamina skim coat): Comply with manufacturer's written instructions.

D. Factory-Prepared Acrylic Finish-Coat Mixes: Comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. General: Coordinate installation of lath, plaster, and accessories with the following:

1. Exterior gypsum sheathing as specified in Division 06 “Exterior Gypsum Sheathing” for exterior gypsum sheathing installed over metal framing.
2. Building wrap and flexible flashing as specified in Division 07 Section “Weather Resistive Barriers.”
3. Sheet metal flashing and trim as specified in Division 07 Section “Sheet Metal Flashing and Trim.”
4. Batt and blanket insulation as specified in Division 07 Section “Thermal and Acoustical Batt Insulation.” Insulation in exterior walls is to be installed prior to installing lath unless insulation is readily installed after lath has been installed on one side.
5. Gypsum board as specified in Division 09 Section “Gypsum Board.” Where practical, install gypsum board at the interior side of exterior walls prior applying plaster materials in order to prevent cracking or damage to plaster surfaces.
6. Rigid foam board insulation specified in Division 07 section “Thermal Foam Plastic Board Wall Insulation” for rigid foam board insulation as a substrate below plaster.

3.3 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Inspect rigid insulation substrates for effects of weathering. Insulation boards that have ‘yellowed’ shall be scrubbed to remove UV-degradation and expose a clean surface or removed and replaced.

3.4 PAPER BACKING

A. Install one layer of paper backing over building wrap specified in Division 07 Section “Weather Resistive Barriers,” where installed over exterior gypsum sheathing for plaster finish without rigid foam insulation board.

B. Apply horizontally with a 3-inch overlap and a 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails.

C. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.

3.5 INSTALLING METAL LATH

A. General: Installation of lath shall be subject to inspection by the enforcing agency.

1. Self-furred lath installation shall be subject to a satisfactory jobsite demonstration with approval by the Architect, the Project Inspector, and the DSA Field Engineer (Per DSA IR 25-4).

B. Metal Lath: Install according to ASTM C 1063, lath manufacturer’s written installation instructions, and as follows:

1. Lath shall be installed with the long dimension perpendicular to supports.
2. Lath shall be fastened to framing members through the rigid insulation and sheathing. Lath shall be fastened to each framing member with not less than No. 10 screws spaced not more than 7 inches on center, fasteners shall have not less than required minimum penetration into framing members.
3. Self-furred lath shall be held out at 1/4 inch minimum from wall substrates and 3/8 inch minimum from ceiling substrates.

3.6 INSTALLING TRIM ACCESSORIES

A. Install according to ASTM C 1063, at locations indicated on Drawings, and as follows:

1. VTruss Corner Reinforcement: Use at outside corners.
2. Double-V Control Joint (#30): Use at interior corners.
3. Cornerite: Use at interior corners.
4. Casing Bead: Use at exposed edges, perimeters of doors, windows, and similar openings, and where indicated on drawings.

5. Foundation Weep Screed: Use at base of walls at grade; weep screeds shall be not less than 2 inches above paved surfaces and 4 inches above earth.
6. Drip Screed: Use at soffit edges.
7. Expansion Joints, Reveals, and Aluminum Trim: Use at locations indicated on Drawings.
8. Control Joints: Unless otherwise indicated on Drawings, provide control joints at locations approved by Architect for visual effect as follows:

    a. Where control joints occur in surface of construction directly behind plaster.
    b. At corners of openings and where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.
    c. As required to delineate plasterwork into areas (panels) complying with the following:

        1) Maximum length-to-width ratio: 2-1/2:1.
        2) Maximum Joint Spacing: 18 feet o.c.
        3) Maximum Area of Vertical Surfaces: 144 sq. ft.
        4) Maximum area of Horizontal Surfaces: 100 sq. ft.

3.7 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Scratch Coat: Apply scratch coat as follows:

1. Apply continuously from architectural break to architectural break with sufficient pressure to ensure keying into lath; cold joints shall not be allowed.
2. Apply in sufficient thickness to substantially cover the lath.
3. Immediately score (scarify) in a predominately horizontal direction.
4. Wipe down all corners and trim accessories and leave no cement protrusions that will interfere with application of brown coat.
5. Place “butterflies” in a diagonal direction delicately onto fresh scratch coat at the apex of window and door penetrations.
6. Keep scratch coat hydrated for a period of 48 hours, follow ASTM and/or TSIB recommendations for curing.
7. Do not apply Brown coat until scratch coat is firm and hard.

C. Brown Coat: Apply brown coat as follows:

1. Pre-wet the scratch coat to avoid excessive suction of moisture from brown coat to avoid accelerated evaporation.
2. Apply continuously from architectural break to architectural break; cold joints will not be allowed.
3. Brown coat shall be applied and filled to the accessory trim grounds, surface to be immediately darbied and/or rodded to a level and plumb plane.
4. When the initial moisture has left brown coat, “hard” float the brown coat to densify, consolidate and prepare for a finish coat. Sponge floats are not acceptable. A hard float shall be considered made from wood shingle, cork, plastic, compact felt or neoprene.

D. Lamina Reinforcement Coat: Apply lamina reinforcement coat of fiberglass mesh and skim coat of polymer cement over brown coat; allow brown coat to cure a minimum of 5 days before applying lamina reinforcement coat.

E. Acrylic-Based Finish Coat: Apply acrylic based finish coat, including primers, over lamina reinforcement coat according to manufacturer's written instructions.

1. Finish texture to be as directed by Architect.

F. Concealed Exterior Plasterwork: Omit finish coat where plaster will be used as a base for adhered finishes.

3.8 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.9 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

SECTION 092900
GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
2. Division 06 Section "Exterior Gypsum Sheathing" for exterior gypsum sheathing.
3. Division 07 Section "Blanket Insulation" for batt and blanket insulation installed in assemblies that incorporate gypsum board.
4. Division 07 Section "Penetration Firestopping" for head-of-wall assemblies that incorporate gypsum board.
5. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
6. Division 09 Section “Painting” for primers applied to gypsum board surfaces.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s product data for each type of product indicated or incorporated into the Work.

1. Include statement of VOC content for any adhesives or sealants.

B. Samples for Verification: For the following:

1. Textured Finishes: Three (3) 48 inch square samples for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, build mockups to demonstrate aesthetic effects and set quality standards for materials and execution. Mockups shall be installed at locations as directed by architect, shall include full walls where practical, and shall not be less than 100 square feet in area.

1. Build mockups to demonstrate the following:

    a. Each level of gypsum board finish indicated for use in exposed locations.
    b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

1. Width: 4 feet.
2. Length: 8, 10, or 12 feet.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum Co.
2. Georgia-Pacific Gypsum, LLC.
3. Lafarge North America Inc.
4. National Gypsum Company.
5. PABCO Gypsum.
6. USG Corporation.

B. Interior Gypsum Wallboard: ASTM C 1396/C 1396M of the following types:

1. Type X:

a. Thickness: 5/8 inch.
b. Long Edges: Tapered.

2. Moisture and Mold-Resistant Type: With moisture and mold-resistant core and surfaces.

a. Core: 5/8 inch, Type X.
b. Long Edges: Tapered.
c. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corp.; FiberCement BackerBoard.
b. Custom Building Products; Wonderboard.
c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.

d. James Hardie Building Products, Inc.; Hardiebacker.
e. National Gypsum Company, Permabase Cement Board.
f. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes: As required for project conditions, including but not limited to the following:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. L-Bead: L-shaped; exposed long flange receives joint compound.
d. U-Bead: J-shaped; exposed short flange does not receive joint compound.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated on Drawings.

1. Basis of Design Manufacturer: Drawings and Specifications are based on products manufactured by:

a. The Fry Reglet Corporation.

1) Subject to compliance with requirements, provide products indicated or equivalent products by one of the following:

a) Gordon, Inc.
b) Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Class II clear anodic finish.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Tile Backing Panels: As recommended by backing panel manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick (20 gage structural and heavier).

2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Insulation: As specified in Division 07 Section "Blanket Insulation."

2.8 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

1. Coordinate primers with Division 09 Section “Painting.”

B. Non-Aggregate Finish: Pre-mixed, vinyl texture finish for spray application.

1. Texture: Orange Peel or light Spatter as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING GYPSUM PANELS, GENERAL

A. Comply with ASTM C 840 and manufacturer's written installation instructions.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 to 3/8-inch wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4 to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Fastening Gypsum Board Panels: Comply with fastening requirements of ASTM C 840 unless more stringent fastening requirements are required for fire resistance rated gypsum board assemblies as indicated on Drawings. Fasten gypsum panels to supports with steel drill screws as follows:

1. Fastener Spacing, Single Layer Gypsum Board Application:

   a. Ceilings: Space fasteners 12 inches on center maximum.
   b. Walls: Space fasteners 12 inches on center maximum where studs are spaced 24 inches on center; fastener spacing may be increased to 16 inches on center where studs are spaced 16 inches on center.
   c. Edge Distance: Space fasteners 3/8 inches minimum from panel edges.

2. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3. Where gypsum panels are installed over structural sheathing or acoustical board panels, increase the length of fasteners an amount equal to not less than the thickness of the sheathing or panels.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Coordinate gypsum panel installation with insulation work specified in Division 07 Section “Blanket Insulation.”

1. Thermal and sound attenuation batt/blanket insulation shall be installed before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side of framing members.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Unless otherwise indicated.

2. Type X: Where required for fire-resistance-rated assemblies.
3. Moisture and Mold-Resistant Type: At walls of toilet and janitor rooms, walls within 2 feet (horizontally) of plumbing fixtures, and other locations as indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.

2. On partitions/walls, apply gypsum panels vertically (parallel to framing) using continuous panels without abutting end joints unless otherwise indicated or required by fire-resistance-rated design.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls where the vertical dimension of the wall without horizontal offsets exceeds the maximum available panel length, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated design.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

4. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers parallel to framing members, as required for single layer application, with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws or as required for fire resistance rated design.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus not less than 12-inch long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches on center. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches on center at framing members.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, provide panels of matching thickness or shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use at exposed panel edges where LC-Bead cannot be used.
4. U-Bead: Use where indicated.
5. Where abutting dissimilar finished materials such as door and window frames, leave a uniform 3/16” gap for backer rod and sealant.

D. Aluminum Trim: Install at locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840 and the Gypsum Association:

1. Level 1: All joints and interior angles shall have tape embedded in joint compound; surface shall be free of excess joint compound; tool marks and ridges are acceptable.

    a. Locations: Concealed areas and areas above ceilings.

2. Level 2: All joints and interior angles shall have tape embedded in joint compound and one separate coat of joint compound applied over all joints, angles, fastener heads, and accessories; surface shall be free of excess joint compound; tool marks and ridges are acceptable.

    a. Locations: Panels that are substrate for applied rigid panels having a thickness not less than 3/8 inches.

3. Level 3: All joints and interior angles shall have tape embedded in joint compound and two (2) separate coats of joint compound applied over all joints,

angles, fastener heads, and accessories; all joint compound shall be smooth and free of tool marks and ridges.

a. Locations: Not used unless otherwise indicated on Drawings.

4. Level 4: All joints and interior angles shall have tape embedded in joint compound and Three (3) separate coats of joint compound applied over all joints, angles, fastener heads, and accessories; all joint compound shall be smooth and free of tool marks and ridges.

a. Locations: At panel surfaces that will be exposed to view and painted or will be substrates for wall coverings.
b. Primer and its application to surfaces are specified in Division 09 Section “Painting.”
c. Where suspended ceilings are to be installed, wall finish shall extend not less than 6 inches above the ceiling height.

5. Level 5: All joints and interior angles shall have tape embedded in joint compound and Three (3) separate coats of joint compound applied over all joints, angles, fastener heads, and accessories; a thin skim coat of joint compound or similar material specific for this purpose shall be applied to the entire surface; the surface shall be smooth and free of tool marks and ridges.

a. Locations: Not used unless otherwise indicated on Drawings
b. Primer and its application to surfaces are specified in Division 09 Section “Painting.”

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes prior to application of finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 093000

TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Ceramic mosaic tile.
2. Glazed wall tile.
3. Crack isolation membrane.
4. Water proof floor membrane.
5. Metal edge strips where indicated.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
2. Division 07 Section “Joint Sealants” for sealing of expansion, contraction, and isolation joints in tile surfaces.
3. Division 09 Section "Portland Cement Plastering" for scratch coat for thickset mortar setting-bed installations.
4. Division 09 Section "Gypsum Board" for tile backing panels.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Face Size: Actual tile size, excluding spacer lugs.

D. Module Size: Actual tile size plus joint width indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type, color, and/or finish from a single source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Waterproofing.
2. Crack isolation membrane.
3. Joint sealants.
4. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Colors, Textures, and Patterns: Where selection of colors, surface textures, patterns, and other appearance characteristics are required, selections shall be made by Architect from manufacturer’s full range unless otherwise indicated.

2.3 TILE PRODUCTS

A. Basis-of-Design Manufacturer: Where named manufacturer products are indicated, Design, Drawings, and Specifications are based on tile products manufactured by the following:

1. Dal-Tile International Corporation.

a. Subject to compliance with requirements, provide products indicated or equal products by one of the following:

1) Crossville Ceramics Company, L.P.
2) Florida Tile Industries, Inc.
3) Summitville Tiles, Inc.
4) Interceramic Tile.
5) United States Ceramic Tile Company.

B. Tile Type CT-1: Factory mounted unglazed ceramic mosaic floor tile.

1. Style Name: Daltile, Keystone Porcelain, Price Group 2.
2. Composition: Porcelain.
3. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
4. Module Size: 2 by 2 inches
5. Thickness: 1/4 inch.
6. Face: Plain with cushion edges.
7. Surface: Smooth, without abrasive admixture.
8. Dynamic Coefficient of Friction: Not less than 0.42.
9. Finish: Mat, opaque.
10. Tile Color and Pattern: As indicated on Drawings or if not indicated, as selected by Architect.
11. Grout Color: As indicated on Drawings or if not indicated, as selected by Architect.
12. Trim Units: Coordinated with sizes, coursing, and matching characteristics of adjoining floor tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base: Cove base, 2 by 1 inch module size.

C. Tile Type CT-2: Glazed Wall Tile.

1. Style Name: Daltile, Color Wheel Classic.
2. Module Size: 4-1/4 by 4-1/4 inches.
3. Thickness: 5/16 inch.
4. Face: Plain with cushion edges.
5. Finish: Bright, opaque; Mat, opaque; or Semimat, opaque glaze per tile as indicated on Drawings, or if not indicated, as selected by Architect from manufacturer’s full range.

    a. Accent Tile Finish: Bright, Opaque; Mat, Opaque; or Semimat, opaque glaze per tile pattern as indicated on Drawings, or if not indicated, as selected by Architect from manufacturer’s full range.

6. Tile Color and Pattern: Assume 2 colors per Men/Women/Unisex toilet room as indicated on Drawings or if not indicated, as provided by Architect.
7. Grout Color: As indicated on Drawings or if not indicated, as selected by Architect.
8. Trim Units: Coordinated with sizes, coursing, and matching characteristics of adjoining floor wall where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Trim for Thin-Set Mortar Installations:

1) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size matching adjoining wall tile.

a) Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining wall tile.

2) External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining wall tile.
3) Internal Corners: Field-butted square corners.

2.4 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

1. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

a. Subject to compliance with requirements, provide one of the following:

1) Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
2) Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.
3) MAPEI Corporation; Mapelastic L (PRP M19).
4) Mer-Kote Products, Inc.; Hydro-Guard 2000.
5) Summitville Tiles, Inc.; S-9000.

b. Apply to recessed concrete slab to extend 2” min. above finish floor height prior to placing mortar bed. Seal to rough-in floor drains & water closet rings.

2.5 CRACK ISOLATION MEMBRANES

A. General: Manufacturer's standard product, selected from the following that complies with ANSI A118.12 for high performance crack isolation membranes, and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

1. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

a. Subject to compliance with requirements, provide one of the following (Waterproof and/or crack isolation membrane):

1) Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
2) Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.
3) MAPEI Corporation; Mapelastic L (PRP M19).
4) Mer-Kote Products, Inc.; Hydro-Guard 2000.
5) Summitville Tiles, Inc.; S-9000.

2.6 SETTING MATERIALS

A. Portland Cement Floor Bed Mortar Installation Materials: ANSI A108.02 with 2% maximum slope to drain.

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Modified Dry-Set Mortar (Thin Set): ANSI A118.4, typical at coved base and walls.

1. Prepackaged dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

a. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Boiardi Products Corporation.
b. Bonsal, W. R., Company.
c. Custom Building Products.
d. LATICRETE International Inc.
e. MAPEI Corporation.
f. Summitville Tiles, Inc.

2.7 GROUT MATERIALS

A. At coved base and wall tiles, provide Polymer-Modified Prepackaged Tile Grout: ANSI A118.7, color as indicated.

B. At tile floors, provide Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Boiardi Products Corporation.
b. Bonsal, W. R., Company.
c. Custom Building Products.
d. LATICRETE International Inc.
e. MAPEI Corporation.

f. Summitville Tiles, Inc.

2.8 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the applicable requirements in Division 07 Section "Joint Sealants."

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Product recommended by manufacturer for sealing grout joints that does not change color or appearance of grout.

1. Grout sealers shall comply with requirements of FloorScore certification.

2.10 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm, dry, clean, and free of coatings that are incompatible with tile-setting materials including curing compounds and other

substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where mortar bed installed tile floors are indicated, prepare substrates by applying a reinforced mortar bed that complies with ANSI A108.1A for use with or without a waterproof membrane, or A108B without a waterproof membrane.

    1. Where tile floors are indicated to be sloped, slope 1/4 inch per foot maximum (2%) toward drains.

D. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

A. Comply with TCNA's " Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. Follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage for tile floors:

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch.
2. Glazed Wall Tile: 1/16 inch.

H. Lay out tile wainscots to next full tile beyond dimensions indicated.

I. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

K. Grout Sealer: Apply grout sealer to grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOF MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.5 CRACK-ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.6 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.7 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 FLOOR TILE INSTALLATION SCHEDULE

A. Floor Tile Installation CT-1: Ceramic tile over mortar bed (thickset) over waterproof membrane over concrete subfloor.

1. Installation Method: TCNA F121 and ANSI A108.1C, Unglazed ceramic or porcelain tile over mortar bed (thickset) over waterproof membrane over concrete.
2. Thin-Set Mortar: Latex-portland cement mortar.
3. Grout: Epoxy unsanded grout.

3.9 WALL TILE INSTALLATION SCHEDULE

A. Wall Tile Installation CT-2: Ceramic tile thinset over cementitious backer board.

1. Installation Method: TCNA W244C and ANSI A108.5, Glazed wall tile thinset over cementitious backer units.
2. Thin-Set Mortar: Latex-portland cement mortar.
3. Grout: Polymer-modified unsanded grout.

END OF SECTION

SECTION 095113
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes acoustical ceiling panels, exposed suspension systems and wire hangers, fasteners, main runners, cross tees, wall angle moldings and perimeter trim for ceilings.

B. Related Requirements:

1. Division 07 Section “Joint Sealants” for acoustical joint sealant.
2. Division 23 and 25-28 for Mechanical grills and electrical lighting, power and data/com systems above and within ceilings.
3. Division 21 for fire suppression piping and sprinklers in ceilings.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include statement of VOC content for any adhesives or sealants.

B. Samples for Initial Selection: For components with factory-applied finishes.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: 6-inch square samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch long Samples of each type, finish, and color.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.

3. Method of attaching hangers to building structure.

    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.

7. Minimum Drawing Scale: 1/8 inch = 1 foot.

E. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

F. Maintenance Data: For finishes to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to not less than 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to not less than 2 percent of quantity installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Ceiling System Components: Ceiling system components shall comply with ASTM C 635 and Section 5.1 of ASTM E 580.

B. Seismic Performance: Suspended ceiling systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the California Building Code.

C. System components and installation shall comply with Division of the State Architect (DSA) Interpretive Regulation IR 25-2, latest edition.

1. Ceiling System General Notes (DSA IR 25-2, Appendix ‘A’ Notes 1.01 - 1.06):

a. IR 25-2, Note 1.01: Ceiling system components shall comply with ASTM C 635 and Section 5.1 of ASTM E 580.
b. IR 25-2, Note 1.02: The ceiling grid system must be rated heavy duty as defined by ASTM C 635.
c. IR 25-2, Note 1.03 and 1.04: Suspension component manufacturer, product number, and Evaluation Report information provided in Part 2 Article “Metal Suspension Systems” of this Specification Section.
d. IR 25-2, Note 1.05: Ceiling panels shall not support any light fixtures, air terminals, or devices.
e. IR 25-2, Note 1.06: For acoustical panels of any material other than mineral or glass fiber, a 3/4 inch clearance shall be provided between the panel and the wall on the sides of the ceiling free to slip. Clearance between ceiling grid runners and walls shall comply with the details on these drawings regardless of ceiling panel material.

2. Materials (DSA IR 25-2, Notes 2.01 - 2.03):

    a. IR 25-2, Note 2.01: Ceiling wire shall be Class 1 zinc coated (galvanized) carbon steel conforming to ASTM A 641. Wire shall be 12 gauge (0.106 inch diameter) with soft temper and minimum ultimate tensile strength of 70 ksi.
    b. IR 25-2, Note 2.02: Galvanized sheet steel (including that used for metal stud compression struts) shall conform to ASTM A 653, or other equivalent sheet steel listed in Section A3.1 of the North American Specification for the Design of Cold-Formed Steel Structural Members (AISI S100). Material 43 mil (18 gauge) thick and lighter shall have a minimum yield strength of 33 ksi. Material 54 mil (16 gauge) thick and heavier shall have a minimum yield strength of 50 ksi.
    c. IR 25-2, Note 2.03: Electrical metallic tubing (EMT) shall conform to ANSI C80.3/UL 797 carbon steel with G90 galvanizing. EMT shall have a minimum yield strength (Fy) of 30 ksi and minimum ultimate strength (Fu) of 48 ksi.

3. Attachment of Hanger and Bracing Wires (DSA IR 25-2, Notes 3.01 - 3.05):

    a. IR 25-2, Note 3.01: All celing hanger and bracing wires shall be separated at least 6 inches from all unbraced ducts, pipes, conduits, etc.
    b. IR 25-2, Note 3.02: Hanger and bracing wires shall not attach to or bend around obstructions including but not limited to piping, ductwork, conduit, and equipment.
    c. IR 25-2, Note 3.03: Hanger wires that are more than one horizontal in 6 vertical out of plumb shall have counter sloping wires.
    d. IR 25-2, Note 3.04: Slack Safety wires shall be considered hanger wires for installation and testing requirements.
    e. IR 25-2, Note 3.05: Hanger and brace wire anchorage to the structure shall be installed in such that the direction of the anchorage aligns with the direction of the wire. Screws in wood shall be installed to align with the direction of the wire.

4. Fasteners and Welding (DSA IR 25-2, Notes 4.01 - 4.07):

    a. IR 25-2, Note 4.01: Sheet metal screws shall comply with ASTM C 1513 ASME B 18.6.3. Penetration of screws through joined material shall not be less than three exposed threads.
    b. IR 25-2, Note 4.02: Expansion anchors shall be as indicated on Drawings including manufacturer, product, engineering service report number, and test load for each size specified.
    c. IR 25-2, Notes 4.03: Power actuated fasteners shall be as indicated on Drawings including manufacturer, product, and engineering service report number.
    d. IR 25-2, Notes 4.04: If not otherwise specified in the evaluation report, power actuated fasteners installed in steel shall be installed so the entire pointed end of the fastener is driven through the steel member.
    e. IR 25-2, Notes 4.05: Power actuated fasteners in concrete or masonry are not permitted for bracing wires.

f. IR 25-2, Note 4.06: Concrete reinforcement and prestressing tendons shall be located by non-destructive means prior to installing post-installed anchors.
g. IR 25-2, Note 4.07: Welding shall be in accordance with AWS D1.3 using E60XX series electrodes.

5. Testing: (DSA IR 25-2, Notes 5.01 - 5.03).

a. IR 25-2, Note 5.01: All field testing must be performed in the presence of the project inspector.
b. IR 25-2, Note 5.02: Post installed anchors in concrete used to support hanger wires shall be tested at a frequency of 10 percent. Power actuated fasteners in concrete shall be field tested for 200 lbs in tension. All other post-installed anchors in concrete shall be tested in accordance with CBC Section 1910A.5.
c. IR 25-2, Note 5.03: Post installed anchors in concrete used to attach bracing wires shall be tested at a frequency of 50 percent in accordance with CBC Section 1910A.5.

6. Luminaires / Light Fixtures (DSA IR 25-2, Notes 6.01 - 6.05):

a. IR 25-2, Note 6.01: All light fixtures shall be positively attached to the ceiling suspension system by mechanical means to resist a horizontal force equal the weight of the fixture. A minimum of two screws or approved fasteners are required at each light fixture per ASTM E 580, Section 5.3.1.
b. IR 25-2, Note 6.02: Surface mounted fixtures shall be attached to the main runner with at least 2 positive clamping devices. The clamping device shall completely surround the supporting ceiling runner and be made of steel with a minimum thickness of 14 gauge. Rotational spring catches are not permitted. A 12 gauge slack safety wire shall be connected from each clamping device to the structure above. Additional supports shall be provided when a light fixtures is 8 feet or longer or exceed 56 lbs. Maximum spacing between supports shall not exceed 8 feet.
c. IR 25-2, Note 6.03: Light fixtures weighing less than or equal to 10 lbs supported directly on the ceiling runners shall have a minimum of one 12 gauge slack safety wire connected from the fixture hosing to the the structure above.
d. IR 25-2, Note 6.04: Light fixtures weighing greater than 10 lbs, but less than or equal to 56 lbs supported directly on the ceiling grid members shall have a minimum of two (2) 12 gauge slack safety wires connected from the fixture housing at diagonal corners to the structure above.

1) Exception: All light fixtures greater than 2 by 4 ft weighing less than 56 lbs shall have a 12 gauge slack safety wire at each corner.

e. IR 25-2, Note 6.05: All light fixtures weighing greater than 56 lbs shall be independently supported from the structure above. See support details on Drawings for additional information.

7. Services within the Ceiling (DSA IR 25-2, Notes 7.01 - 7.04):

    a. IR 25-2, Note 7.01: All flexible sprinkler hose fitting mounting brackets, ceiling mounted air terminals, or other services, shall be positively attached to the ceiling suspension system by mechanical means. Screws or other fasteners specified on the Drawings are required. A minimum of 2 attachments are required at each component.
    b. IR 25-2, Note 7.02: Ceiling mounted services weighing less than or equal to 20 lbs shall have one 12 gauge slack safety wire attached from the terminal or service to the structure above.
    c. IR 25-2, Note 7.03: Ceiling mounted services weighing more than 20 pounds but less than or equal to 56 pounds shall have two 12 gauge slack safety wires (at diagonal corners) connected from the terminal or service to the structure above.
    d. IR 25-2, Note 7.04: Ceiling mounted services weighing more than 56 pounds shall be independently supported from the structure above. See support details on theses Drawings for additional information.

8. Other Devices within the Ceiling (DSA IR 25-2, Note 8.01):

    a. IR 25-2, Note 8.01: All lightweight miscellaneous devices, such as strobe lights, occupancy sensors, speakers, exit signs, etc., shall be attached to the ceiling grid. Devices weighing more than 10 lbs shall have a 12 gauge slack safety wire anchored to the structure above. Devices weighing more than 20 lbs shall be independently supported from the structure above.

2.2 ACOUSTICAL PANELS

A. Source Limitations, Acoustical Ceiling Panels: Obtain acoustical panels from a single source from a single manufacturer.

B. Manufacturer, Basis-of-Design Products: Where named manufacturer’s products are indicated, Drawings and Specifications are based on products manufactured by:

1. Armstrong World Industries, Inc.

    a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

        1) BPB USA.
        2) CertainTeed Corp.
        3) USG Interiors, Inc.; Subsidiary of USG Corporation.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

D. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

E. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

F. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

G. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

H. Acoustical Panel Types:

1. Type ACP-1: Armstrong World Industries; Cortega, No. 769.

a. Size: 24 x 48 x 5/8 inches.
b. Edge: Square lay-in.
c. Composition: Mineral fiber, water felted.
d. Surface Texture: Medium fissured.
e. Finish: Factory painted finish, white.
f. Noise Reduction Coefficient (NRC): 55.
g. Ceiling Attenuation Class (CAC): 35. ASTM xxxx
h. Light Reflectance (LR): 0.80, ASTM E 1477 (White).
i. LR: Not less than 0.80.
j. NRC: Not less than 0.55.

2. Type ACP-2: (Not Used).

3. Type ACP-3: Armstrong World Industries; Ceramaguard, Unperforated, No. 605.

a. Size: 24 x 48 x 5/8 inches.
b. Edge: Square lay-in.
c. Composition: Ceramic and mineral fiber composite, water felted.
d. Surface Texture: fine fissured.
e. Finish: Factory applied plastic paint finish, white, washable.
f. Noise Reduction Coefficient (NRC): NA.
g. Ceiling Attenuation Class (CAC): 40.
h. Light Reflectance (LR): 0.86, ASTM E 1477 (White).
i. Meets USDA/FSIS guidelines for use in food service processing areas.

2.3 METAL SUSPENSION SYSTEMS

A. Source Limitations, Suspension Systems: Obtain suspensions systems from a single source from a single manufacturer.

B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M, and Section 5.1 of ASTM E580.

1. Main runners, cross runners, splices, expansion devices, and intersection connectors shall be designed to carry a mean ultimate test load of not less than 180 lbs in compression and tension per ASTM E 580 Section 5.1.2.

C. Wide-Face, Capped, Double-Web Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet.
5. Cap Finish: Painted white for ACP-1 & ACP-2; Painted orange for ACP-3.
6. Basis of Design: Design, Drawings, and Specifications are based on the following:

    a. Armstrong World Industries, Prelude XL (ESR-1308).

        1) Main Runners: No. 7301.
        2) Cross Runners: No. XL7341 (4’), XL7328 (2’).
        3) Perimeter Seismic Clips: No. BERC2.

    b. Design is based on a ceiling system using proprietary perimeter seismic clips and approved by DSA; substitutions will require a Substitution Request and processing a DSA Construction Change Document.

D. Edge Moldings and Trim: Manufacturer's standard roll formed sheet metal angle edge molding and trim with hemmed edges having nominal 7/8 inch legs, that fit acoustical panel edge details and suspension systems indicated, and comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Perimeter Seismic Clips: Provide manufacturer’s proprietary perimeter seismic clips at ends of main and cross runners at wall angles to comply with seismic standards indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.4 ACCESSORIES

A. Postinstalled Anchors in Concrete: Post installed expansion anchors shall be as indicated on Drawings with holes or loops for attaching wires.

1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
2. Field Testing: Post installed anchors in concrete shall be tested in accordance with Part 3 Article “Field Quality Control.”

B. Power-Actuated Fasteners in Concrete: Power actuated fasteners as indicated on Drawings fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching wires of type indicated.

1. Field Testing: Power actuated fasteners in concrete shall be tested in accordance with Part 3 Article “Field Quality Control.”
2. Power actuated fasteners in concrete shall not be used for securing brace wires to the structure.

C. Power-Actuated Fasteners in Steel: Power actuated fasteners shall be as indicated on Drawings fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching wires of type indicated.

1. Power actuated fasteners installed in steel shall be installed so the pointed end of the fastener is driven through the steel member unless otherwise indicated in the evaluation report.

D. Sheet Metal Screws: Comply with ASTM C1513-10, ASME B18.6.4-89 (R2005). Penetration of screws through joined material shall be not less than three exposed threads.

E. Hanger and Brace Wires: Class 1 zinc-coated (galvanized) carbon-steel wire conforming to ASTM A 641-09a; wire to be 12 gauge (0.106 inch diameter) with soft temper and minimum tensile strength of not less than 70 ksi.

F. Seismic Struts: Metal stud sections of size indicated on Drawings of galvanized steel sheet conforming to ASTM A653-17, or other equivalent sheet steel listed in Section A3.1 of the North American Specification for the Design of Cold-Formed Steel Structural Members 2016, including supplement 2 dated 2020 (AISI S100-16/S2-20). Material 43 mil (18 gauge) and lighter shall have a minimum yield strength of 33 ksi; material 54 mil (16 gauge) and heavier shall have a minimum yield strength of 50 ksi.

2.5 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Division 07 Section “Joint Sealants." Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.

2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M, Section 5.2 of ASTM E 580, and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Ceiling System Installation shall comply with DSA IR 25-2, latest edition; requirements included in Part 2 Article “Performance Requirements” of this specification Section.

3.4 INSTALLATION OF HANGER AND BRACE WIRES

A. Anchors and/or Clips for Hanger and Brace Wires: Anchors and/or Clips for hanger and brace wires shall be installed in such a manner that the direction of the anchor/clip aligns as closely as possible with the direction of the wire.

B. Hanger Wires: Suspend ceiling hanger wires from the building's structural members and attach to grid members as indicated on Drawings and as follows:

1. Install hanger wires spaced not more than 4 feet on center along main runners and not more than 8 inches from ends of runners at the perimeter of the ceiling.
2. Install hanger wires at cross runners at the perimeter of the ceiling area not more than 8 inches from edges or one-fourth the length of the runner whichever is least. Perimeter wires are not required when the length of the runner is 8 inches or less.
3. Install hanger wires plumb and free from contact with insulation or other objects within the space above the ceiling that are not part of supporting structure or of ceiling suspension system. Hanger wires shall be separated from unbraced pipes, ducts, conduits, and similar items a minimum of 6 inches.
4. Secure hanger wires to ceiling suspension grid members and to supports above with a minimum of three tight turns in 3 inches. Hanger wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops.
5. Hanger wires shall not attach to or bend around interfering material or equipment. Provide trapeze or other supplementary support members at obstructions to typical hanger spacing.
6. Provide additional hangers, struts, or braces as required at all ceiling breaks, soffits, or discontinuous areas.
7. Splay hanger wires only where required to miss obstructions; hanger wires that are more than one horizontal to 6 vertical out of plumb shall have counter sloping wires. Counter sloping wires are not required at perimeter hanger wires at main runners that are positively attached to the perimeter wall closure angle.

C. Seismic Bracing/Hanger Wires and Compression Struts: Seismic bracing shall consist of a compression strut and sets of 4 splayed brace wires oriented 90 degrees from each other attached to suspension grid main runners and the structure above as indicated on Drawings and as follows:

1. Space bracing assemblies not more than 12 feet on center each way and not more than 6 feet from walls.
2. Secure brace wires to ceiling suspension main runners and to building structural members above with a minimum of four tight turns in 1-1/2 inches.

    a. Brace wires shall attach to main runners within 2 inches of the intersection of main and cross runners.
    b. The slope of brace wires shall not exceed 45 degrees from the plane of the ceiling.
    c. Brace wires shall be separated from unbraced pipes, ducts, conduits, and similar items a minimum of 6 inches.

3. Compression struts shall attach to ceiling grid main runners at the intersection of the brace wires and shall be installed not more than 1 horizontal to 6 vertical out of plumb.

4. Ceiling areas of 144 square feet or less surrounded by walls attached or braced to the structure above shall not require seismic bracing.

    a. Free floating ceilings (Ceilings not entirely surrounded by walls on all sides) shall be seismically braced regardless of area.

3.5 INSTALLATION OF GRID MEMBERS AND WALL TRIM

A. Edge Molding and Trim: Install trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Positively attach trim to the wall as indicated on Drawings.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 24 inches on center and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

B. Suspension Grid Members: Install suspension grid members so they are level, square, and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

1. Install grid members to form standard 2 foot x 4 foot or 2 foot by 2 foot grid layout as indicated on Drawings.

    a. Main runners shall be spaced 4 feet on center and shall be supported by hanger wires spaced not more than 4 feet on center along the main runner.
    b. 4 foot long cross runners shall be installed perpendicular to main runners and spaced 24 inches on center.
    c. 2 foot long cross runners shall be installed perpendicular to the 4 foot cross runners at the mid-point of the 4 foot cross runners (For 2 foot by 2 foot grid layouts).

2. Grid members shall be attached to metal wall angle trim two adjacent walls per ASTM E 580, Section 5.2.3; grid members shall be at least 3/4 inches clear of other walls.

    a. Proprietary seismic clips shall be installed at each grid member at walls of the ceiling area where grid members are not connected to the adjacent wall angle trim; seismic clips shall be securely fastened to the wall; seismic clips shall allow the grid member 3/4 inch movement in compression and in tension.

3. Expansion joints shall be provided between grid members at the intersections of corridors and at the junctions of corridors and lobbies or similar areas.
4. Seismic separations shall be provided to divide large ceiling areas into smaller areas so that no undivided ceiling area exceeds 2,500 sf. Alternately, comply with ASTM E 580, Section 5.2.9

3.6 INSTALLATION OF ACOUSTIC CEILING PANELS

A. Acoustic Panels: Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. Provide oversize penetrations through ceiling panels for sprinkler heads and similar rigid penetrating items that are not connected to the ceiling system; penetrations shall be 2 inches minimum oversized to allow for horizontal movement of 1 inch in all directions.

    a. Penetrations shall be finished with escutcheons to seal off oversized openings; escutcheons shall allow for movement of 1 inch minimum in all directions
    b. Flexible pipe penetrations shall not require oversize openings.

4. Arrange directionally patterned acoustical panels with pattern running in one direction.

5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.7 INSTALLATION OF ACCESSORIES

A. Light Fixtures: All light fixtures shall be positively attached to the ceiling suspension system by mechanical means per CEC Article 410.36 to resist a horizontal force equal the weight of the fixture. A minimum of two screws or approved fasteners are required at each light fixture per ASTM E 580, Section 5.3.1.

1. Surface mounted fixtures shall be attached to the main runner with at least 2 positive clamping devices on each fixture; the clamping device shall completely surround the supporting ceiling runner and be made of 14 gauge minimum thickness sheet steel; rotational spring catches do not comply. A 12 gauge slack safety wire shall be attached to each clamping device and to the structure above. Provide additional supports when light fixtures are 8 feet or longer or exceed 56 lbs. Maximum spacing between supports shall not exceed 8 feet.
2. Light fixtures weighing not more than 10 lbs shall have a minimum of one 12 gauge slack safety wire connected to the fixture hosing and the structure above.
3. Light fixtures weighing more than 10 lbs, but not more than 56 lbs, may be supported directly on the ceiling grid members, but they shall have a minimum of two 12 gauge slack safety wires connected to the fixture housing at diagonal corners and anchored to the structure above. Light fixtures greater than 2 by 4 ft weighing less than 56 lbs shall have a 12 gauge slack safety wire at each corner.

4. Light fixtures weighing more than 56 lbs shall be independently supported by not less than 4 taut 12 gauge wires attached to the fixture housing, one at each corner, and the structure above; the 4 taut wires, including their attachment to the structure, must be capable of supporting 4 times the weight of the fixture.
5. Pendant mounted fixtures shall be supported directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting 2 times the weight of the fixture. Refer to DSA IR 16-9 for additional requirements for pendant fixtures.

B. Fire Sprinklers: Flexible sprinkler hose fittings, if provided, shall be positively attached to the ceiling suspension system by mechanical means to resist a horizontal force equal to the weight of the component; screws or approved fasteners are required. A minimum of 2 attachment points are required at each component.

1. Flexible sprinkler hose fittings weighing not more than 20 lbs shall have one 12 gauge slack safety wire attached to the fitting and the structure above.
2. Flexible sprinkler hose fittings weighing more than 20 lbs, but not more than 56 lbs, shall have a minimum of two 12 gauge slack safety wires connected to the fixture housing and the structure above.
3. Flexible sprinkler hose fittings weighing more than 56 lbs shall be independently supported by not less than 4 taut 12 gauge wires attached to the fixture and the structure above. The 4 taut wires including their attachment to the structure must be capable of supporting 4 times the weight of the fixture.

C. Air Terminals and Other Services: Ceiling mounted air terminals and/or other services shall be positively attached to the ceiling suspension system by mechanical means to resist a horizontal force equal to the weight of the component; screws or approved fasteners are required. A minimum of 2 attachment points are required at each component.

1. Ceiling mounted air terminals and/or other services weighing not more than 20 lbs shall have one 12 gauge slack safety wire attached to the terminal or service and the structure above.
2. Ceiling mounted air terminals and/or other services weighing more than 20 lbs, but not more than 56 lbs, shall have a minimum of two 12 gauge slack safety wires connected to the terminal or service and the structure above.
3. Ceiling mounted air terminals and/or other services weighing more than 56 lbs shall be independently supported by not less than 4 taut 12 gauge wires attached to the terminal or service and the structure above. The 4 taut wires including their attachment to the structure must be capable of supporting 4 times the weight of the terminal or service.
4. Lightweight miscellaneous devices, such as strobe lights, occupancy sensors, speakers, exit signs, etc., shall be attached to the ceiling suspension system by mechanical means to resist a horizontal force equal to the weight of the component; screws or approved fasteners are required. A minimum of 2 attachment points are required at each component.

    a. Devices weighing more than 10 lbs, and not exceeding 20 lbs, shall have a minimum of one 12 gauge slack safety wire connected to the fixture hosing and the structure above.

b. Devices weighing more than 20 lbs shall be independently supported by not less than 4 taut 12 gauge wires attached to the fixture and the structure above. The 4 taut wires including their attachment to the structure must be capable of supporting 4 times the weight of the fixture.

D. Metal and Other Panels: Metal panels and panels weighing more than 1/2 psf, other than mineral fiber acoustic panels, shall be positively attached to the suspension grid members.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements. Field testing shall be performed in the presence of the project inspector. Testing and inspecting shall be required for the following:

1. Post installed anchors in concrete for hanger and brace wires.

   a. Hanger Wires: Within each test area, testing agency will select 1 of every 10 anchors (10%) used to attach hanger wires to concrete and test them for 200 lbf of tension.
   b. Brace Wires: Within each test area, testing agency will select 1 of every 2 anchors (50%) used to attach brace wires to concrete and test them in accordance with CBC Section 1913A.7.

2. Power-actuated anchors in concrete for hanger wires.

   a. Hanger Wires: Within each test area, testing agency will select 1 of every 10 anchors used to attach hanger wires to concrete and test them for 200 lbf of tension.

      1) Power actuated fasteners in concrete shall not be permitted for brace wires.

3. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

C. Remove and replace hangers, anchors, and fasteners that do not pass tests and inspections and retest as specified above.

3.9 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096001
FLOORING MOISTURE AND pH TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control for flooring moisture and pH testing of interior concrete slabs.

1. Owner will engage a qualified testing agency to perform tests and inspections.

B. Related Sections include the following:

1. Division 01 Section “Quality and Testing Requirements.”
2. Division 03 Section “Topical Concrete Vapor Control Barrier”
3. Division 09 Sections as applicable to adhered flooring materials.

1.3 REFERENCES

A. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride.

B. ASTM F 710 Standard Practice for Preparing Concrete Floors to receive Resilient Flooring.

C. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.4 TESTING AGENCY

A. General: Owner will engage a qualified testing agency to conduct tests and inspections specified.

1. Costs for testing agency services will be paid by the Owner.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be paid by the Owner and the amount will be deducted from the Contract Sum by Change Order.

B. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Perform testing as required by the Contract Documents.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Taking all test specimens.
4. Prepare written reports of tests and inspections, and submit reports of each test, inspection, and similar quality-control service to Architect and Contractor.
5. Retesting and reinspecting corrected work.
6. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
7. Do not perform any duties of Contractor.

1.5 CONTRACTOR REQUIREMENTS

A. Contractor Responsibilities:

1. Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

   a. Access to the Work.
   b. Incidental labor and facilities necessary to facilitate tests and inspections.

2. Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

   a. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Testing shall not occur until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Maintain ambient temperatures within range recommended by manufacturers of flooring products, but not less than 68 deg F or more than 80 deg F, in spaces to receive adhered flooring products during the following time periods:

   a. 48 hours before testing.
   b. During testing.
   c. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturers of flooring products, but not less than 68 deg F or more than 80 deg F.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. The following materials and equipment shall be the responsibility of the Owner's testing agency:

1. Test Kit as manufactured by American Moisture Test, Inc., Tramex, LTD.

a. ASTM F 1869 water vapor emission test.
b. ASTM F 2170 relative humidity test.
c. ASTM F 710 digital alkalinity-pH, wide range 1-14pH.

PART 3 - EXECUTION

3.1 PREPARATION

A. Contractor Responsibilities: Prepare concrete substrates according to ASTM F 710 and flooring manufacturers' written instructions to ensure adhesion of resilient products.

1. Verify that substrates are dry, free of curing compounds, sealers, and hardeners, and are compatible to receive adhesive applied flooring products.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Mechanically abrade and/or grind a 20 inch by 20 inch area to remove adhesives, paint, curing/sealing compounds, and similar residue a minimum of 24 hours prior to application of testing equipment at each test location for water vapor emission testing.

a. Do not abrade surface where topical concrete vapor control barriers have been applied; clean surface of contamination and directly apply testing equipment to treated surface(s) without scarification methods.

B. Temperature and Humidity: Maintain spaces at the temperature and humidity conditions anticipated during normal occupancy and as specified in Part 1 Article "Field Conditions" before, during, and after testing.

1. Testing shall be performed under HVAC controlled conditions, testing performed without HVAC controlled conditions shall be subject retesting prior to flooring application.

3.2 TESTING

A. Testing: Testing Agency shall perform tests as follows:

1. Anhydrous calcium chloride test, ASTM F 1869.

    a. Do not mechanically abrade concrete surfaces that have been treated with a topical vapor control barrier.
    b. Perform all gram scale weights on site.
    c. Expose dome for 60 to 72 hours.
    d. Report results as pounds of emission per 24 hours per ASTM F 1869.

        1) Satisfactory results shall have a maximum moisture-vapor-emission rate of not more than 3 lb of water/1000 sq. ft. in 24 hours.

2. Relative humidity test using in situ probes, ASTM F 2170.

    a. Test method not required for areas sealed with Topical Vapor Control Barrier.
    b. Satisfactory results shall have a maximum 75 percent relative humidity level measurement.

3. Testing for pH:

    a. Apply pH solution to form a 1-inch diameter circle directly to interior of moisture dome.
    b. Allow to absorb into concrete for 1 minute.
    c. Apply flat tip pH meter to solution and document result as required by manufacturer.

        1) Satisfactory results shall be in the pH range 5 minimum to 9 maximum.

4. Frequency of Testing: Apply tests at a rate of three (3) test locations for areas up to 1,000 square feet and one (1) test per each 1,000 square feet thereafter. Note test location and number on next to test for future identification.

5. Do not proceed with flooring installation until satisfactory results are achieved or a topical vapor control barrier is applied.

3.3 REPAIR

A. General: On completion of testing, contractor shall repair damaged construction and restore substrates and finishes.

1. Use materials for patching identical to in-place materials; refer to applicable specification sections for materials and installation. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
2. Comply with the requirements Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

D. Test Results shall be reported similar to the below American Moisture Test “Report 100”:

Interior Test Conditions	Relative Humidity (%)	Air Temp. (°F)
Start of Test		
End of Test		
ASTM Requirement	50 ± 10 % RH	75 ± 10º F

Results	Moisture Vapor Emission Rate (MVER) / Relative Humidity	pH
Highest	/	
Lowest	/	
Acceptable	3.0 lbs. / 75% RH	9.0pH

Location	ASTM F-1869-04 Calcium Chloride Data							Results	
	Start Date/Time	End Date/Time	Elapsed Time	Start Weight	Ending Weight	Weight Gain	Concrete Surface Temp Start / End	Digital pH	MVER / Relative Humidity

END OF SECTION

SECTION 096513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include statement of VOC content for any adhesives or sealants.

B. Samples for Initial Selection: For color and texture for each product indicated.

C. Product Schedule: For resilient products, use same designations as Contract Documents.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.
2. Burke / Mannington Commercial.
3. Roppe Corporation, USA.

B. Resilient Base: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style: Cove (base with toe).
2. Minimum Thickness: 0.125 inch.
3. Height: 6 inches typical at walls (RB-2), 4 inches typical at cabinet toe spaces (RB-1) and ends and other heights as otherwise indicated on Drawings.
4. Lengths: Cut lengths 48 inches long, or coils in manufacturer's standard length.
5. Outside Corners: Preformed.
6. Inside Corners: Job formed or preformed.
7. Colors: As selected by Architect from full range of industry colors.
8. Provide straight (not coved) bottom base at stair stringers where indicate, cut to fit treads and risers.

2.2 RESILIENT MOLDING ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries, Inc.

2. Burke / Mannington Commercial.
3. Roppe Corporation, USA.

B. Resilient Molding Accessories: Flooring terminations, transitions, reducer strips, and accessories as indicated and/or required for project conditions.

1. Material: Rubber.
2. Profile and Dimensions: As indicated in Drawings and/or as required for project conditions.
3. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: VOC content of not more than 50 g/L.
b. Rubber Floor and Stair Tread Adhesives: VOC content of not more than 60 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Outside Corners: Install preformed corners; install corners before installing straight pieces.

H. Inside Corners: Install preformed or job formed inside corners.

1. Preformed Corners: Install preformed corners before installing straight pieces.
2. Job-Formed Corners: Use straight pieces of maximum lengths possible and form returns with not than 6 inches in length, miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 096519
RESILIENT LUXURY VINYL FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient luxury vinyl tile flooring.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for concrete floor substrates.
2. Division 03 Section "Topical Concrete Vapor Control Barrier."
3. Division 09 Section "Flooring Moisture and pH Testing."
4. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 SUBMITTALS

A. Product Data: For each type of resilient flooring product including adhesives and accessories.:

B. Sustainable Design Submittals:

1. Documentation of VOC content for adhesives.
2. Documentation indicating resilient flooring complies with the requirements of California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).

A. Shop Drawings: For resilient flooring.

1. Include resilient flooring layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

B. Samples: For each type of resilient flooring, include manufacturer’s color charts or samples.

C. Product Schedule: For resilient flooring, use same designations indicated on Drawings.

D. Qualification Data: For Installer.

E. Maintenance Data: For each type of flooring to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of plank flooring installed.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for flooring installation indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store plank flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store plank flooring on flat surfaces.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive plank flooring during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during plank flooring installation.

D. Close spaces to traffic for 48 hours after plank flooring installation.

E. Install resilient flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Sustainability Requirements: Resilient flooring shall comply with the California Green Building Standards Code, Section 5.504.4.6, resilient flooring shall meet the requirements of California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).

C. Accessibility Requirements: Floor surfaces shall be stable, firm, and slip resistant and shall comply with California Building Code Section 11B-302. Flooring edge trim shall comply with California Building Code Section 11B-303; 1/2 inch maximum overall height, 1/4 inch maximum vertical, 2H:1V bevel between 1/4 inch and 1/2 inch high.

2.2 RESILIENT LUXURY VINYL PLANK FLOORING

A. Resilient Luxury Vinyl Plank Flooring: Commercial grade luxury vinyl plank flooring for glue down installation.

B. Basis of Design: Design, Drawings, and Specifications are based on the following:

1. Mohawk Group; Commercial Grade Luxury Vinyl Tile.

a. Collection: Hot and Heavy.
b. Style: Metal, No. C0059.
c. Color: Proper Gray, No. 929
d. Size: 18 inches by 36 inches nominal.
e. Tile Standard: ASTM F 1700, Class III, Printed Film Vinyl Tile, Type B embossed.
f. Overall Thickness: 0.2 inches (5MM) overall thickness.
g. Wear Layer Thickness: 20 mil (0.5 mm).
h. Installation Method: As selected by Architect from available options
i. Installation Pattern: As selected by Architect from available options

2. Subject to compliance with requirements, provide product indicated or submit request for substitution.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit plank flooring and substrate conditions indicated.

1. Adhesives shall have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Concrete Slabs: Verify that finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to flooring manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove coatings, including curing compounds and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and flooring manufacturers.

    a. Do not abrasively clean concrete substrates have been treated with a topical concrete vapor control barrier; comply with requirements of vapor control barrier manufacturer.

3. Moisture Testing: Owner will engage a testing agency to perform tests for moisture vapor emission, humidity, and pH per Division 09 Section “Flooring Moisture and pH Testing.” In the absence of Owner testing, perform the following tests; perform tests so that each test area does not exceed 1,000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb

of water/1000 sq. ft. in 24 hours unless manufacturer recommendations are more stringent.

b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement unless manufacturer recommendations are more stringent.
c. Alkalinity Testing: Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
d. Perform additional moisture tests recommended in writing by adhesive and carpet manufacturers. Proceed with installation only after substrates pass testing.

4. Adhesion Testing: Perform tests recommended by flooring manufacturer.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install flooring until flooring products are same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient flooring.

3.3 RESILIENT FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient flooring.

B. Lay out resilient flooring from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.
2. Lay resilient flooring in direction indicated on Drawings.

C. Match resilient flooring for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

D. Scribe, cut, and fit resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend resilient flooring into toe spaces, under accessible sink counters/cabinets, door reveals, closets, and similar openings. Extend resilient flooring to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient flooring as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Adhere resilient flooring to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient flooring.

B. Perform the following operations immediately after completing resilient flooring installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient flooring products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Polish resilient flooring if recommended by flooring manufacturer. Remove soil, adhesive, and blemishes from resilient flooring surfaces before applying liquid floor polish, apply (2) two coats.

E. Cover resilient flooring until Substantial Completion.

END OF SECTION

SECTION 096723

RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Urethane cement composition flooring and base.
2. Portland cement floor setting bed mortar substrate over waterproof membrane.

B. Related Sections:

1. Division 03 Section "Cast-Place Concrete" for finishing of concrete slabs.
2. Division 11 Section “Food Service Equipment” for coordination of walk-in coolers and freezers.
3. Division 22 Plumbing Section(s) as applicable to floor drains and floor clean outs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including installation/application instructions and VOC content of liquid materials.

B. Shop Drawings: Include installation, application, transition, and termination details.

C. Samples for Initial Selection: Manufacturer's color samples showing the full range of colors and patterns available for each flooring type indicated.

D. Samples for Verification: Submit 4 by 4 inch sample of color chips from color chart selection designated by the Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of resinous flooring.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build mockup for each resinous flooring system and substrate to receive coatings.
2. Size: 200 sq. ft. of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity which complies with manufacturer’s written instructions.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply resinous floor system coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply products to damp or wet substrates, when temperatures are below 65 deg F, or above 85 deg F.

B. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

D. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

1. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.10 COORDINATION

A. Coordinate requirements for finishing of concrete slabs with Division 03 Section “Cast-in-Place Concrete.”

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction. For coatings and adhesives applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Floor Coatings: 100 g/L.
2. Adhesives: 50 g/L.
3. Primers and Sealers: 100 g/L.

B. Accessibility Requirements:

1. Floor surfaces shall be stable, firm, and slip resistant and shall comply with California Building Code Section 11B-302.
2. Flooring edge trim shall comply with California Building Code Section 11B-303; 1/2 inch maximum overall height, 1/4 inch maximum vertical, 2H:1V bevel between 1/4 inch and 1/2 inch high.

2.2 MATERIALS, GENERAL

A. Material Compatibility: Provide primers; base, intermediate, topcoat, and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Source Limitations: Obtain resinous floor system coatings from a single source from a single manufacturer.

2.3 URETHANE CEMENT COMPOSITION FLOORING

A. Description: Multi-component polyurethane mortar flooring system consisting of the application of a screeded mortar base coat, broadcast aggregate, and clear urethane sealer applied over prepared concrete floors.

B. Basis-of-Design: Drawings and Specifications are based on the following:

1. Stonhard, Inc.; StoneClad UR Floor System

a. Subject to compliance with requirements, provide product indicated or equivalent product manufactured by one of the following:

1) Terroxy Resin Systems, 7H-901-1400 (Sales)

C. Physical Properties:

1. Applied Thickness: 1/8 inch to 1/4 inch.
2. Compressive Strength: 5,000 psi per ASTM C 579,
3. Tensile Strength: 700 psi per ASTM C 307.
4. Flexural Strength: 1,800 psi per ASTM C 580.
5. Surface Hardness: 80 to 84, ASTM D 2240, Shore D.
6. Impact Resistance: 160 inch/lbs, ASTM D2794
7. Flammability: Class I, ASTM E 648.
8. Thermal Coefficient of Linear Expansion: 1.3 x 10^5 inch/inch Deg. F, ASTM C 531.
9. Water Absorption: <1%, ASTM C 413.
10. VOC Content: 5 g/l, ASTM D 2369, Method E.
11. Coefficient of Friction (Dry): Less than 1.0 (Standard Texture); 0.96 (Medium Texture), ASTM F 1679.

D. Color: As selected by Architect from manufacturer’s full range.

E. Static Coefficient of Friction: Provide products with a minimum static coefficient of friction of 0.6 as determined by testing identical products per ASTM C 1028.

F. Base: Coved base integral with floor coating, 6 inches high, unless indicated otherwise.

G. Flooring System Components: Manufacturer's standard components that are compatible with each other and as follows:

1. Primer: Flooring system manufacturer's standard urethane primer for floor system specified.
2. Mortar Base: Flooring system manufacturer's standard polyurethane mortar for floor system specified.

a. Aggregates: Flooring system manufacturer's standard quartz pigmented blended aggregate for floor system specified.

H. Primer: As recommended in writing by flooring system manufacturer.

2.4 ACCESSORY MATERIALS

A. Waterproof Membrane: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer and compatible with:

1. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement easement flooring.

a. Subject to compliance with requirements, provide one of the following:

1) Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
2) Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.
3) MAPEI Corporation; Mapelastic L (PRP M19).
4) Mer-Kote Products, Inc.; Hydro-Guard 2000.
5) Summitville Tiles, Inc.; S-9000.

b. Apply to recessed concrete slab to extend 2" min. above finish floor height prior to placing mortar bed. Seal to rough-in floor drains & other floor fixtures.

B. Setting Materials: Portland Cement Floor Bed Mortar Installation Materials: ANSI A108.02 with 1.5% maximum uniform slope to drain over cured waterproof membrane.

1. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.

2. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed Portland cement and aggregate mortar bed.

C. Patching and Fill Material: Resinous product of or approved by resinous floor system manufacturer and recommended by manufacturer for application indicated.

D. Joint Sealant: Type recommended or produced (NSF certified at kitchens) by resinous floor system manufacturer for type of service and joint condition indicated.

E. Control-Joint Strips: Separate, double L-type stainless steel angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.

F. Accessory Strips: Match divider strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Base-bead strips for exposed top edge of epoxy-resin coved base, except where wall panel J-molds are installed by others.

2. Edge-bead strips for exposed edges of epoxy resin.

G. Cant Strip: Molded of flooring resin materials 1/2 to 3/4 inch radius, or as otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of coating work. Coordinate with wall panel installers on installation of J-molds to be installed above coved base.

B. Verify that substrates are visibly dry and free of moisture.

C. Proceed with installation only after substrate construction and penetrating work have been completed, J-molds at bottom of wall panels have been properly installed, and unsatisfactory conditions have been corrected.

1. Begin application only after minimum concrete-curing and drying period recommended in writing by resinous flooring manufacturer has passed and after substrates are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. General: Before applying coatings, clean and prepare substrates according to manufacturer's written instructions to produce clean, dust-free, dry substrate for coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by manufacturer.

B. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.

C. Mask adjoining surfaces not receiving coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent coating materials from entering substrate penetrations and clogging weep holes and drains.

D. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

E. Concrete Substrates: Remove grease, oil, form release agents, paints, curing compounds, and other penetrating contaminants or film forming coatings from concrete.

1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D 4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D 4258.
2. Remove concrete fins, ridges, and other projections.
3. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.
4. Verify that concrete substrates are visibly dry and free of moisture.
5. Test for moisture by anhydrous calcium chloride method according to ASTM F 1869 per Division 09 Section “Flooring Moisture and Alkalinity Testing.” Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

F. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

G. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to flooring system manufacturer's written recommendations.

3.3 URETHANE FLOORING SYSTEM INSTALLATION

A. Apply each component of flooring system according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated including integral cove base.

B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Integral Cove Base: Apply flooring system manufacturer’s cove base mortar mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, of cove base. Round internal and external corners to radius required by local health department, 5/8 inch minimum at floor to base inside corner.

D. Trowel apply mortar base coat in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.

E. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.4 TERMINATIONS

A. Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal resinous system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.5 JOINTS AND CRACKS

E. Treat control joints to bridge potential cracks and to maintain monolithic protection.

F. Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

G. Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.6 ACCESSORIES INSTALLATION

A. Cove Base: Apply coved base mix to wall surface at locations shown to corm cove base height of 6 inches unless otherwise indicated. Follow manufacturer’s instructions and details including taping, mixing, priming, troweling, sanding, and top-coating of coved base.

B. Cure resinous flooring materials according to manufacturer’s directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.

3.7 CLEANING AND PROTECTION

A. Protection: Provide protection and maintain conditions, in a manner acceptable to Installer, that ensure that resinous flooring is without damage or deterioration at time of Substantial Completion. Where temporary covering is provided, comply with flooring system manufacturer's recommendations for protective materials and method of application.

B. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring system manufacturer.

END OF SECTION

SECTION 096816

CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Modular carpet tile.

B. Related Requirements:

1. Division 03 Section “Topical Concrete Vapor Control Barrier” for concrete vapor control.
2. Division 09 Section "Flooring Moisture and pH Testing" for testing of concrete floor substrates.
3. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of carpet, adhesives, and accessory materials.

1. Carpet: For each type indicated, include manufacturer's written data on physical characteristics, durability, fade resistance, and installation recommendations for each type of substrate.

B. Shop Drawings: For carpet installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Locations where dye lot changes occur.
4. Type of subfloor.
5. Type of installation.
6. Pattern type, repeat size, location, direction, and starting point.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full size sample.

D. Product Schedule: For carpet. Use same designations indicated on Drawings.

E. Sustainable Product Certification:

1. Provide ANSI/NSF 140 certification for carpet products.
2. Documentation indicating carpet installed in the building interior meets the requirements of California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).
3. Documentation of VOC content for adhesives.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by manufacturer for installation of manufacturer's products or installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet installation including, but not limited to, the following:

    a. Delivery, storage, and handling procedures.
    b. Ambient conditions and ventilation procedures.
    c. Subfloor preparation procedures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104 for delivery, storage and handling.

1.10 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.11 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

    a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
    b. Dimensional instability.

c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Delamination.

3. Warranty Period: (15) Fifteen years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND REGULATORY REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Sustainability Requirements: Carpet shall comply with California Green Building Standards Code, Section 5.504.4.4: Carpet installed in the building interior shall meet the requirements of California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emissions testing method for California Specification 01350).

C. Accessibility Requirements (CBC 11B-302.2): Carpet shall be securely attached to floor and shall have firm backing and no cushion. Carpet shall have a level loop, textured loop, level cut pile, level cut/uncut pile texture. Pile height shall be 1/2 inch maximum. Exposed edges of carpet shall be fastened to floor surfaces and shall have trim on the entire length of the exposed edge. Carpet edge trim shall comply with CBC Section 11B-303, 1/2 inch overall height, 1/4 inch maximum vertical, 2H:1V bevel between 1/4 inch and 1/2 inch high.

2.2 CARPET

A. Carpet, CPT-1: Modular Carpet Tile.

1. Basis-of-Design Product: Drawings and Specifications are based on the following:

a. Patcraft; Gemscape Collection, Surface Striation 10552, color Feldspar No. 00150, or other color as selected by Architect from manufacturer’s full line.

1) Subject to compliance with requirements, provide product indicated or submit request for substitution in compliance with Division 01 Section “Substitution Procedures.”

2. Properties and Characteristics:

a. Construction: Multi-level pattern loop.
b. Carpet Tile Size: 24 inches by 24 inches.
c. Face Weight: 24 oz/sq yd.

d. Gauge: 1/10.
e. Stitches per Inch: 10.
f. Finished Pile Thickness: 0.118 inches.
g. Average Density: 4,881 oz./sq. yd.
h. Total Thickness: 0.245 inches.
i. Tufted Yarn Weight: 16 oz./sq. yd.
j. Mergeable Dye Lot: Yes.
k. Fiber Type: EcoSolution Q100™ nylon.
l. Dye Method: 100% Solution Dyed.
m. Primary Backing: Non-woven synthetic.
n. Secondary Backing: StrataWorx® Tile.
o. Protective Treatment: SSP® Shaw Soil Protection.
p. Testing:

    1) Pill Test CPSC FF 1 70: Pass.
    2) Radiant Panel ASTM E648: Class I.
    3) NBS smoke ASTM E662 NF: <450.
    4) Static AATCC 134: <3.5 kv.
    5) Coefficient of Friction: 0.6 (Meets ADA/CBC requirements).

q. Installation Method: Glue down.
r. Installation Pattern: As directed by Architect.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

1. Adhesives shall have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, pH range, installation tolerances, and other conditions affecting carpet performance.

B. Examine carpet for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet manufacturer's written installation instructions for preparing substrates.

B. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet manufacturers.

1. Moisture Testing: Owner will engage a testing agency to perform tests for moisture vapor emission, humidity, and pH per Division 09 Section “Flooring Moisture and pH Testing.” In the absence of Owner testing, perform the following tests; perform tests so that each test area does not exceed 1,000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

   a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours unless manufacturer recommendations are more stringent.

   b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement unless manufacturer recommendations are more stringent.

   c. Alkalinity Testing: Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than9 pH.

   d. Perform additional moisture tests recommended in writing by adhesive and carpet manufacturers. Proceed with installation only after substrates pass testing.

   e. Adhesion Testing: Perform tests recommended by carpet manufacturer.

C. Use trowelable leveling and patching compounds according to manufacturer's written instructions to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 MODULAR CARPET TILE INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7 “Post Installation.”

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION

SECTION 097723

VINYL COVERED TACKBOARD PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Unframed vinyl fabric wrapped tackable wall panels (vinyl covered tackboard) adhesively mounted to wall substrates.

B. Related Sections include the following:

1. Division 09 Section “Gypsum Board” for typical substrate.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Documentation of VOC content for adhesives.

B. Shop Drawings: Included plans and elevations showing location and extent of each panel type, indicate joints, termination points, and edge details.

C. Samples for Initial Selection: Fabric facing material selections from panel manufacturer's full range.

D. Samples for Verification: Fabric facing material for each type of fabric selected. Prepare Samples from same material to be used for the Work, 6 inch square minimum size.

E. Maintenance Data: For wall coverings to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. For each color, and pattern installed, provide full size panels in quantity equal to not less than 5 percent of amount installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

C. Protect panel edges from crushing and impact.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall panels until spaces are enclosed and weather tight, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are achieved and maintained at the levels anticipated for Project when occupied for its intended use.

1. Condition materials and spaces for not less than 48 hours before installation.
2. Maintain established temperature and humidity conditions until final completion.

B. Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Class A; flame-spread index of 25 or less; smoke developed index of 450 or less.

2.2 VINYL COVERD TACKBOARD WALL PANELS

A. Source Limitations: Obtain panels through one source from a single manufacturer.

B. Basis of Design Manufacturer: Design, Drawings, and Specifications are based on panels manufactured by the following:

1. Chatfield Clarke Co.

a. Subject to compliance with requirements, provide products by the manufacturer indicated or a comparable manufacturer subject to Request for Substitution prior to bidding.

C. Vinyl Covered Tackable Wall Panels: Manufacturer's standard vinyl fabric wrapped tackboard wall panels as follows:

1. Panel Substrate: Cellulosic wood fiber board, ASTM C 208, 1/2 inch thickness.

a. Width: 4 feet.
b. Length: 8, 9, and 10 foot lengths as standard with manufacturer and as required by project conditions.
c. Surface Burning Characteristics: Class B, flame spread of 75 or less when tested in accordance with ASTM E84.
d. Edges: Square.

2. Fabric: Backed vinyl fabric as follows:

a. Manufacturer: Koroseal Wallcoverings, a Division of RJF International Corporation.
b. Fabric Width: 54 inches.
c. Type I, Group I Fabric:

1) Total Weight (Oz./Lineal yard, 54 inch width): 15.0.
2) Total Weight (Oz./Square yard): 10.0.
3) Backing: Sheeting.

d. Type I, Group II Fabric:

1) Total Weight (Oz./Lineal yard, 54 inch width): 18.0.
2) Total Weight (Oz./Square yard): 12.0.
3) Backing: Sheeting.

e. Type I, Group III Fabric:

1) Total Weight (Oz./Lineal yard, 54 inch width): 15.0.
2) Total Weight (Oz./Square yard): 10.0.
3) Backing: Sheeting.

f. Type II Fabric:

1) Total Weight (Oz./Lineal yard, 54 inch width): 21.0.
2) Total Weight (Oz./Square yard): 14.0.
3) Backing: Osnaburg.

g. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Class A; flame-spread index of 25 or less; smoke developed index of 450 or less.

h. Color and Pattern: As selected by Architect from Manufacturer's full range. One color per room, up to 4 colors per project.

2.3 FABRICATION

A. Fabric facing shall be stretched tight and square and be fully adhered to substrate panels. Adhered fabric shall be free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Long edges shall be wrapped and fabric returned around the back face of panels for 1-1/2 inches.

2.4 ACCESSORIES

A. Trim: J and H-shaped extruded vinyl trim with exposed faces wrapped with vinyl fabric to match panels.

B. Adhesive: Mildew-resistant, non-staining adhesive, for use with specific wall panel and substrate application, and as recommended in writing by wall panel manufacturer.

1. Adhesive shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each wall area and establish layout of panels, balance widths at opposite ends of each wall. Avoid using less-than-half-width panels at ends of walls and comply with layout shown on Drawings.

3.3 INSTALLATION OF WALL PANELS

A. Adhere panels to walls according to manufactures written installation instructions.

1. Temporary nailing used to hold panels in place during setting of adhesive shall be removed; nails shall be of a size and type that will leave no evidence of nailing in the vinyl covering when the nails are removed.

B. Install wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

1. Install panels vertically, continuous from floor to ceiling without horizontal joints unless distance is greater than the maximum available panel length. Where horizontal joints cannot be avoided, provide H-shaped trim between panels.
2. Vertical Joints: Tightly butt fabric wrapped edges.

C. Extend panels above suspended ceilings as indicated on the Drawings.

D. Cut panels to be at least 50 percent of panel width. At longitudinal cuts, leave excess fabric and wrap cut edge and back face of panel with fabric to match uncut edges, secure fabric to panel with adhesive recommended in writing by manufacturer.

E. Edge and Corner Trim: Provide edge and corner trim at exposed ends, edges, terminations, outside corners, and where necessary to conceal edges of panels. Miter corners of trim.

3.4 CLEANING

A. Clean panels according to manufacturer's written instructions on completion of installation to remove dust and other foreign materials.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, to ensure that wall panels are without damage or deterioration at time of Substantial Completion.

B. Replace wall panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Final Inspection.

END OF SECTION

SECTION 099100

PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and field painting, staining or refinishing of the following:

1. Exposed exterior items and surfaces.
2. Exposed interior items and surfaces.
3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Related Sections include but are not limited to the following:

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
3. Division 08 Sections for shop priming of metal doors and frames with primers specified in this Section.
4. Division 09 Section "Gypsum Board" for sealing gypsum board surfaces before application of surface textures with primers/sealers specified in this Section.
5. Division 21 through 23 Sections for additional requirements for painting of plumbing and mechanical items.
6. Division 26 through 28 Sections for additional requirements for painting of electrical items.

1.3 DEFINITIONS

A. Definitions of gloss levels below are from "MPI Architectural Painting Specification Manual" (hereafter, "MPI Manual").

1. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
2. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
3. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

4. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
5. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
6. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on 8 inch square samples of actual material to be painted or stained. For masonry surfaces, include a mortar joint.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

E. Coating Maintenance Manual: Submit with Closeout/Maintenance Submittals a Coating Maintenance manual; manual shall include a floor plan with rooms identified by name and number, a finish schedule coordinated with the floor plan, designations of where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).

3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F.

1. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
2. Keep storage area neat and orderly. Remove oily rags and waste daily.
3. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply paints only when the temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Protection:

1. Cover or otherwise protect finished work of other trades, work not to be painted concurrently, landscaping, and adjacent property from damage.
2. When not in use, store paints in designated areas. Keep containers closed. At end of day's work, remove empty containers, paint soaked rags, and debris. Vent fumes. Take precautions to prevent fire.

D. Sequencing, Scheduling:

1. Coordinate removal and replacement of hardware, electrical fixtures and trim, and related work of other Sections.
2. Stain, prime, back paint, and pre-finish items before installation as required.

E. Cleaning and Disposal:

1. Do not use Project plumbing fixtures or piping systems for:

a. Cleaning painting equipment and utensils.
b. Disposal of waste from cleaning or disposal of paints.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Scheduled Paint Systems: Provide paint systems as scheduled on the Drawings and listed in Part 3 Article “Paint Systems” to comply with requirements in this Section.

1. Named Manufacturers' Products: Manufacturer and product designations indicated in the scheduled paint systems are for the purpose of establishing minimum requirements; unless otherwise indicated, paint products are based on products manufactured by the following:

a. Sherwin Williams Paints.

1) Subject to compliance with requirements, provide the named products or comparable products by one of the following:

a) Dunn-Edwards Paints.
b) Glidden Professional.
c) PPG Paints.
d) Tnemec.
e) Vista Paints

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

C. VOC Content: Paints and coatings applied at the Project site shall comply with VOC limits of authorities having jurisdiction; VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); and VOC limits of the California Green Building Standards Code (CGBSC), Section 5.504.4.3 and Table 504.4.3 as follows:

1. Flat Paints and Coatings: VOC not more than 50 g/L.
2. Nonflat Paints and Coatings: VOC not more than 100 g/L.
3. Nonflat High-Gloss Paints and Coatings: VOC not more than 150 g/L.
4. Dry-Fog Coatings: VOC not more than 150 g/L.
5. Floor Coatings: VOC not more than 100 g/L.
6. Pretreatment Wash Primers: VOC not more than 420 g/L.
7. Primers, Sealers, and Undercoaters: VOC not more than 100 g/L.

8. Rust Preventative Coatings Applied to Ferrous Metals: VOC not more than 250 g/L.
9. Shellacs, Clear: VOC not more than 730 g/L.
10. Shellacs, Pigmented: VOC not more than 550 g/L.
11. Stains: VOC not more than 250 g/L.
12. Clear Wood Finishes, Varnishes: VOC not more than 275 g/L.
13. Clear Wood Finishes, Lacquers: VOC not more than 275 g/L.
14. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.

D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Public Health' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Colors: Provide color selections made by the Architect. Colors shall be factory mixed and match approved samples.

2.3 INTUMESCENT PAINTS

A. Intumescent Paint: Water based latex post treatment interior fire retardant intumescent paint; non-toxic and mold resistant.

1. Product: Flame Stop Inc.; Flame Stop IM.
2. Flame Spread: Zero (0) per ASTM E 84; 30 Minute Test Method of Test of Surface Burning Characteristics of Building Materials.
3. VOC Content: Not more than 50 g/L.
4. Applied Thickness: Two coats, each coat applied at a rate of 200 sf/gal.
5. Color and Gloss: As selected by Architect from manufacturer's full range.
6. Substrate Primers: Primers approved by intumescent paint manufacturer; use where manufacturer recommends use of a primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Portland Cement Plaster: 12 percent.
5. Gypsum Board: 12 percent.

C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

D. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

G. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect of anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
2. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

D. Concrete and Masonry Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Perform appropriate tests to determine alkalinity and moisture content of surfaces; testing shall be performed or witnessed by a certified representative of the paint manufacturer. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

1. Cracks and defects at concrete and masonry surfaces shall be filled with cement grout; match surface texture.
2. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. Steel Structures Painting Council's (SSPC), SSPC-SP 3, "Power Tool Cleaning."
2. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Aluminum Substrates: Remove loose surface oxidation.

I. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required.

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood.

    a. When transparent finish is required, backprime with spar varnish.
    b. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
    c. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

J. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

K. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

L. Drywall: Fill any cracks or defects with drywall joint compound. Sand any rough spots smooth. Do not raise nap on paper covering.

3.3 APPLICATION

A. General: Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual." Paint/stain exposed surfaces, except where schedules indicate that a surface or material is not to be painted/stained or is to remain natural. If schedules do not specifically mention an item or surface to be painted, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
7. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
8. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
9. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

    a. Prefinished items include the following factory-finished components:

        1) Aluminum storefronts and entrances.
        2) Anodized aluminum gypsum board and plaster trim.
        3) Acoustical wall panels.
        4) Toilet and urinal partitions.
        5) Stainless steel items.
        6) Finished mechanical and electrical equipment.
        7) Light fixtures.
        8) Distribution cabinets.

    b. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

F. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions and recommendations in "MPI Manual."

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

G. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed

surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

N. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Paint the following work where exposed to view at applications indicated:

1. Equipment rooms:

a. Telecommunications backboards; paint with intumescent paint.

2. Occupied areas:

a. Equipment, including panelboards.

b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Ducts, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
i. Other items as directed by Architect.

3. Exterior locations:

a. Equipment, including panelboards.

b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.

g. Tanks that do not have factory-applied final finishes.

3.4 CLEANING AND PROTECTION

A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. Correction of Defective Work:

1. Repair abraded, damaged or incomplete paint surfaces by methods acceptable to Architect. Spot repairs to be well-blended into adjacent work. For large repairs, re-coat entire plane or building element in which damaged area occurs.
2. Defaced surfaces of work not to be painted shall be cleaned and their original finish restored.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 PAINT SYSTEMS

(Interior and exterior paint systems are on the following pages)

A. Interior Paint Systems:

SURFACE		PAINT SYSTEM		COATS	MANUFACTURER'S DESIGNATION	
(1)	Gypsum Drywall	P12.A	Flat, Latex	First Coat Second Coat Third Coat	B28 B30 B30	ProMar 200 Zero Primer ProMar 200 Zero Flat ProMar 200 Zero Flat
		P12.B	Semi-Gloss Latex	First Coat Second Coat Third Coat	B28 B31 B31	ProMar 200 Zero Primer ProMar 200 Zero SG ProMar 200 Zero SG
		P12.C	Eggshell Enamel Latex	First Coat Second Coat Third Coat	061 B20 B20	ProMar 200 Zero Primer ProMar 200 Zero EG ProMar 200 Zero EG
	(Textured)	P12.D	Flat	One Coat	A44	Tuff Surface
(2)	Wood	P13.A	Semi-Gloss Latex	First Coat Second Coat Third Coat	B28 B31 B31	Premium Wall & Wood ProMar 200 Zero SG ProMar 200 Zero SG
		P13.B	Eggshell Enamel, Latex	First Coat Second Coat Third Coat	168 A75 A75	Premium Wall & Wood Solo EG Solo EG
		P13.C	Lacquer Velvet	Stain First Coat Second Coat Third Coat	 15700 27520 27520	Minwax 250 Sanding Sealer High Solids Velvet Lacquer High Solids Velvet Lacquer
		P13.D	Lacquer Semi-Gloss	Stain First Coat Second Coat Third Coat	 15700 27540 27590	Minwax 250 Sanding sealer High Solids S.G. Lacquer High Solids S.G. Lacquer
		P13.E	Lacquer Gloss	Stain First Coat Second Coat Third Coat	 15700 27590 27590	Minwax 250 Sanding Sealer High Solids Gloss Lacquer High Solids Gloss Lacquer
		P13.F	Varnish Velvet	Stain First Coat Second Coat Third Coat	 A68 A68 A68	Minwax 250 Wood Classics Wood Classics Wood Classics
		P13.G	Varnish Semi-Gloss	Stain First Coat Second Coat Third Coat	 A68 A68 A68	Minwax 250 Wood Classics Wood Classics Wood Classics
(2A)	Telecom Plywood Backboard	P13.H	Intumescent Paint	Primer First Coat Second Coat		(Primer if req. by intumescent paint mfr) Flame Stop IM Flame Stop IM

SURFACE		PAINT SYSTEM		COATS	MANUFACTURER'S DESIGNATION	
(3)	Ferrous Metal	P14.A	Flat Latex	First Coat Second Coat Third Coat	B66310 A74 A74	ProCryl Metal Primer Solo Flat SoloFlat
		P14.B	Semi-Gloss Latex	First Coat Second Coat Third Coat	B66310 A76 A76	ProCryl Metal Primer Solo SG Solo SG
	Ferrous Metal (Cont.)	P14.C	Eggshell Latex	First Coat Second Coat Third Coat	B66310 A75 A75	ProCryl Metal Primer Solo EG Solo EG
(4)	Galvanized Metal/ Aluminum	P15.A	Flat Latex	First Coat Second Coat Third Coat	B66310 A74 A74	ProCryl Metal Primer Solo Flat Solo Flat
		P15.B	Semi-Gloss Latex	First Coat Second Coat Third Coat	B66310 A76 A76	ProCryl Metal Primer Solo SG Solo SG
		P15.C	Eggshell Latex	First Coat Second Coat Third Coat	B66310 A75 A75	ProCryl Metal Primer Solo EG Solo EG
(5)	Plaster, Concrete, Brick	P16.A	Flat Latex	First Coat Second Coat Third Coat	LX02 B30 B30	Loxon ProMar 200 Zero Flat ProMar 200 ZeroFlat
		P16.B	Semi-Gloss Latex	First Coat Second Coat Third Coat	LX02 B31 B31	Loxon ProMar 200 Zero SG ProMar 200 Zero SG
		P16.C	Eggshell Latex	First Coat Second Coat Third Coat	LX02 B20 B20	Loxon ProMar 200 Zero EG ProMar 200 Zero EG
(6)	Concrete Block	P17.A	Flat latex	First Coat Second Coat Third Coat	B25 B30 B30	PrepRite Block Filler ProMar 200 Zero Flat ProMar 200 Zero Flat
		P17.B	Semi-Gloss Latex	First Coat Second Coat Third Coat	B25 B31 B31	PrepRite Block Filler ProMar 200 Zero SG ProMar 200 Zero SG
		P17.C	Eggshell Latex	First Coat Second Coat Third Coat	B25 B20 B20	PrepRite Block Filler ProMar 200 Zero ProMar 200 Zero
(7)	Acoustical Ceiling Tile/ Plaster	P18.A	Latex	One Coat to Cover	A21	EcoSelect
(8)	Ceramic Tile like Finishes	P19.A	Epoxy	First Coat Second Coat Third Coat	B51 B73 B73	Multi Purpose Primer PI Waterbased Epoxy PI Waterbased Epoxy

SURFACE		PAINT SYSTEM		COATS	MANUFACTURER'S DESIGNATION	
(9)	Ceiling and Wall w/ misc. Pipes & Conduit Exposed, Trusses & Beams w/Spray-on Fire Insulation	P20.A	Latext Dry Fall	One Coat	B42	PI Waterbased Dryfall White or Black
(10)	Floor Coating, concrete or wood	P21.A	2 Part Epoxy Floor Coating, Semi-Gloss	First Coat Second Coat	8100 8100	Armorseal 8100 Water Based Epoxy Floor Coating Armorseal 8100 Water Based Epoxy Floor Coating
(11)	Various (Smoke Damage)	P22.a	Shellac Primer	Two Coats		White Pigmented Shellac Primer B49W08050

(Exterior Paint Systems start on the following page)

B. Exterior Paint Systems:

SURFACE		PAINT SYSTEM		COATS	MANUFACTURER'S DESIGNATION	
(1)	Plaster, Concrete	P50.A	Flat, Acrylic	First Coat Second Coat Third Coat	LX02 A6 A6	Loxon A-100 A-100
		P50.B	Low Sheen Enamel Acrylic	First Coat Second Coat Third Coat	LX02 126 126	Loxon A-100 A-100
		P50.C	Elastomeric (Smooth) 5 year labor warranty	First Coat Second Coat Third Coat (Spray App.)	LX02 CF12 CF12	Loxon Masonry Primer Conflex XL Conflex XL
		P50.D	Elastomeric (Medium Aggregate) 5 year labor warranty	First Coat Second Coat Third Coat	LX02 CF12 CF12	Loxon Masonry Primer Conflex XL Conflex XL
(2)	Concrete Block Masonry	P51.A	Flat, acrylic emulsion	First Coat Second Coat Third Coat	B25 A6 A6	PrepRite Block Filler A-100 A-100
		P51.B	Elastomeric Smooth 5 year labor warranty	First Coat Second Coat Third Coat	LX02 CF12 CF12	Loxon Masonry Primer Conflex XL Conflex XL
		P51.C	Elastomeric (Medium Aggregate) 5 year labor warranty	First Coat Second Coat Third Coat	LX02 CF12 CF12	Loxon Masonry Primer Conflex XL Conflex XL
		P51.D	Elastomeric (Coarse Aggregate)	First Coat Second Coat Third Coat	LX02 CF12 CF12	Loxon Masonry Primer Conflex XL Conflex XL
		P51.E	Clear Water Repellent 10 year Warranty	1 Coat	LX31	Loxon 40% Water Repellant (A31T40)
(3)	Wood	P53.A	Flat Acrylic Emulsion	First Coat Second Coat Third Coat	B42 A6 A6	Exterior Wood Primer A-100 A-100
		P53.B	Semi-Gloss Acrylic	First Coat Second Coat Third Coat	B42 A76 A76	Exterior Wood Primer Solo SG Solo SG
		P53.C	Low Sheen Enamel Acrylic	First Coat Second Coat Third Coat	B42 A75 A75	Exterior Wood Primer Solo LS Solo LS

SURFACE		PAINT SYSTEM		COATS	MANUFACTURER'S DESIGNATION	
(3) (Cont.)	Wood	P53.D	Flat, Stain, Water Base, Semi-Transp.	First Coat Second Coat	A15T A15T	Deckscapes ST Stain Deckscapes ST Stain (A15T00215)
		P53.E	Flat, Stain Opaque	First Coat Second Coat	A6 A6	A100 A100
		P53.F	Varnish Clear Gloss	First Coat Second Coat Third Coat	6509 6509 6509	McCloskey's Spar McCloskey's Spar McCloskey`s Spar
		P53.G	Stain and Varnish	First Coat Second Coat Third Coat	 6509 6509	Aqua Seal McCloskey's McCloskey's
(4)	Ferrous Metal	P55.D	Gloss, High Perform.	First Coat Second Coat Third Coat	646 B65 B65	Macropoxy Epoxy Acrolon 100 Acrolon 100
		P55.E	Semi-Gloss High Perform.	First Coat Second Coat Third Coat	B66-310 B66 B66	ProCryl Primer Pro Ind DTM Acrylic Pro Ind DTM Acrylic
(5)	Galv. Metal & Aluminum	P56.A	Gloss	First Coat Second Coat Third Coat	B66-310 A77 A77	ProCryl Primer Solo GL Solo GL
		P56.B	Flat, Acrylic	First Coat Second Coat Third Coat	B66-310 A74 A74	ProCryl Primer Solo Flat Solo Flat
		P56.C	Semi-Gloss Enamel Acrylic	First Coat Second Coat Third Coat	B66-310 B53 B53	ProCryl Primer PI WB Urethan Enamel PI WB Urethan Enamel
		P56.D	Gloss	First Coat Second Coat Third Coat	B66-310 A77 A77	ProCryl Primer Solo GL Solo GL
		P56.E	Semi Gloss	First Coat Second Coat Third Coat	B66-310 A76 A76	ProCryl Primer Solo S/G SoloS/G
(6)	Galv. Metal & Aluminum	P57.C	Gloss High Perform.	First Coat Second Coat Third Coat	646 B65 B65	Marcopoxy Epoxy Acrolon 100 High Gloss Acrolon 100 High Gloss
	High Perf.	P57.D	Semi-Gloss High Perform.	First Coat Second Coat Third Coat	B71Y1 B66 B66	DTM Wash Primer Pro Ind DTM Acrylic Pro Ind DTM Acrylic

END OF SECTION

SECTION 101116

MARKER AND TACK BOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Framed, steel faced porcelain enameled marker board assemblies.
2. Framed, combination steel faced porcelain enameled marker board and vinyl faced tack board assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated; include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for marker and tack board assemblies.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: Schedule including types, locations, sizes, mounting heights, and other data pertinent to installation.

D. Samples: For color and finish selection for each of the following:

1. Facing surface for marker boards.

2. Fabric surface for tack boards.

1.4 INFORMATIONAL SUBMITTALS

A. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For marker and tack board assemblies to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated marker and tack board assemblies completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

B. Store marker and tack board assemblies vertically with packing materials between each unit. Do not store flat or stacked.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install marker and tack board assemblies until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.8 COORDINATION

A. Support Backing: Coordinate blocking and backing for wall anchorage of marker and tack boards with wall framing.

1.9 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Surfaces lose original writing and erasing qualities.
    b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: Life of the building.

B. Special Warranty for Tack Boards: Manufacturer's standard form in which manufacturer agrees to repair or replace tack boards that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten (10) years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.2 MARKER AND TACK BOARD ASSEMBLIES

A. Manufacturers:

1. Subject to compliance with requirements, provide products by one of the following manufacturers:

a. Best-Rite; MooreCo, Inc.
b. Claridge Products & Equipment, Inc.
c. Marsh Industries, Inc.
d. Platinum Visual Systems; a division of ABC School Equipment, Inc.

2. Source Limitations: Obtain marker board and tack board assemblies from a single source from a single manufacturer.

B. Marker and Tack Board Assemblies: Factory fabricated assemblies with trim and accessories indicated.

1. Marker board assemblies and combination marker and tack board assemblies shall be factory fabricated as single units.
2. Combination Marker and Tack Board Configuration: As indicated on drawings, approximately 1/3 width as tack board and 2/3 width as marker board.
3. Corners: Square.
4. Height: 4 feet unless otherwise indicated.
5. Length: As indicated on drawings; 5, 8, 10, 12, 16 or 20 feet, single units without joints or splicing up to 20 feet.
6. Mounting: Mechanically fastened direct to wall as indicated on Drawings.

C. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard panel assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

1. Face Sheet: Porcelain enamel steel face sheet, PEI-1002, with face sheet manufacturer's standard two or three-coat process.

a. Face Sheet Thickness: 0.021-inch uncoated base metal thickness.
b. Color: White.
c. Gloss Level: Low gloss.

2. Core: One of the following:

    a. Particleboard, 7/16-inch-thick; ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.
    b. MDF, 7/16-inch-thick; ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.

3. Backing Sheet: Aluminum foil, not less than 0.005 inches thick.
4. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

D. Tack Board Panels: Vinyl-fabric-faced tack board panel of core indicated.

1. Facing: Vinyl fabric, mildew resistant, washable, complying with FS CCC-W-408D, Type LI, fine weave; weighing not less than 13 oz./sq. yd.; color and pattern as selected by Architect.

    a. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

        1) Flame-Spread Index: 25 or less.
        2) Smoke-Developed Index: 450 or less.

2. Tackable Substrate: 1/4 inch thick cork surface consisting of linseed oil, granulated cork and rosin binders calendared onto a natural burlap backing.
3. Core Material: MDF, 1/4-inch-thick; ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.

E. Frames and Trim: Extruded aluminum frame and trim fabricated from not less than 0.062-inch thick aluminum, ASTM B 221 (ASTM B 221M), Alloy 6063; manufacturer’s standard size and shape with clear anodized satin finish. Frames and trim to be factory applied. Trim to be straight and of single lengths, miter corners to form neat, hairline joints.

F. Combination Assemblies: Provide manufacturer's standard exposed trim between abutting sections of visual display panels.

G. Marker Tray: Manufacturer's standard continuous extruded aluminum box type tray with slanted front, grooved tray, and cast-aluminum end closures.

H. Map/Display Rail and Accessories: Manufacturer’s standard extruded aluminum rail with cork tackable insert, designed to hold accessories.

1. Display Rail Size: 2 inches high by full length of marker board unit.
2. Tackable Insert Color: As selected by Architect from manufacturer’s full range.
3. Aluminum Finish: Match marker board trim.
4. Accessories:

    a. Map Hooks with Clips: Map hooks with flexible metal clips, two clips for every 48 inches of map rail or fraction thereof.

b. Flag Holder: One for each room.

I. Joints: Make joints only where total length exceeds 20 foot maximum manufactured length. Fabricate with minimum number of joints, with joints located as indicated on Drawings. Make joints using manufacturer's standard vertical-joint spline system between abutting sections of markerboards.

2.3 MARKER BOARD ACCESSORIES

A. Dry Erase Markers: Dry erase markers as recommended by marker board manufacturer.

1. One four pack of markers for each marker board; four pack to include one each black, blue, red, and green markers.

B. Marker Board Eraser: Marker board eraser as recommended by marker board manufacturer; one per each marker board, two for marker boards twelve feet or longer.

2.4 FINISHES

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Aluminum Finish: Clear anodic finish, AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper backing for visual display units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of, and affect the smooth, finished surfaces of visual display boards.

3.3 INSTALLATION OF MARKER AND TACK BOARD ASSEMBLIES

A. General: Install marker and tack board assemblies in locations and at mounting heights indicated on Drawings. Install with perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, brackets, anchors, trim, and accessories necessary for complete installation.

B. Fasten marker and tack board assemblies to walls as detailed on the Drawings using concealed clips, hangers, and grounds attached to wall surfaces and to marker board assemblies with fasteners spaced not more than 16 inches on center. Secure both top and bottom of units to walls.

3.4 CLEANING AND PROTECTION

A. Clean marker board assemblies according to manufacturer's written instructions. Attach one removable cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION

SECTION 101400

SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior and exterior panel signs for room or space identification.

B. Related Sections:

1. Division 01 Section “Temporary Facilities and Controls” for Project identification signage.
2. Division 10 Section “Dimensional Character Signage” for individual character signs.
3. Division 10 Section “Cast Metal Plaques” for cast metal dedication plaques.
4. Division 10 Section “Photoluminescent Exit Signs” for photoluminescent signs.
5. Division 22, 23, and 26 Sections as applicable to Plumbing, Mechanical, and Electrical Work for tags and nameplates for equipment.
6. Division 32 Section “Paving Specialties” for parking lot and pedestrian signage.

1.3 SUBMITTALS

A. Product Data: Manufacturer’s product data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and full-scale template layout of characters and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

1. Provide message list for each sign, including large-scale details of wording, lettering, and Braille layout.

C. Schedule: Schedule indicating sign locations, type, other pertinent data, and referenced to rooms or doors with the same referencing as used on the Drawings.

D. Braille Text Certification: Provide certification from the sign manufacturer that Braille text complies with regulatory requirements indicated (Contracted (Grade 2) per CBC Section 11B-703.3).

E. Braille Text Translation Confirmation: Provide confirmation of Braille text translations.

F. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for each type of sign and material indicated.

G. Samples for Verification: Provide 2 full size sample signs showing edge and corner condition, border, text characters of height specified, Braille text, and selected colors, of each type of sign indicated. Sample will be retained by Architect.

H. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each sign type through one source from a single manufacturer.

1.5 FIELD CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to replace signs that fail in materials or workmanship within specified warranty period.

1. Damage from deliberate destruction and vandalism is excluded.
2. Warranty Period for Interior Signs: Building lifetime.
3. Warranty Period for Exterior Signs: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS FOR SIGNS

A. Regulatory Requirements: Comply with requirements of the following:

1. 2010 ADA Standards for Accessible Design.
2. ANSI A117.1.

3. California Building Code, Sections 11B-216 and 11B-703.

B. Room or Space Identification Signs, CBC 11B-216.2: Where provided, signs identifying permanent rooms and spaces shall comply with CBC Sections 11B-703.1, 11B-703.2, 11B-703.3, and 11B-703.5. Where pictograms are provided as designations of permanent rooms and spaces, the pictograms shall comply with CBC Section 11B-703.6 and shall have text descriptors complying with CBC Sections 11B-703.2 and 11B-703.5. Exterior signs that are not located at the door to the space they serve shall not be required to comply with CBC Section 11B-703.2.

C. Directional and Informational Signs, CBC 11B-216.3: Signs that provide direction to or information about spaces and facilities shall comply with CBC Section 11B-703.5.

D. Means of Egress Signs, CBC 11B-216.4: Tactile exit signs required by CBC Section 1013.4 at doors to exit passageways, exit discharge, and exit stairways shall comply with CBC Sections 11B-703.1, 11B-703.2, 11B-703.3, and 11B-703.5.

E. Inspection, CBC 11B-703.1.1.2: Signs and identification devices shall be field inspected after installation and approved by the enforcing agency prior to the issuance of a final certificate of occupancy per Chapter 1, Division II, Section 111, or final approval where no certificate of occupancy is issued. The inspection shall include, but not be limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with the regulations of CBC Section 11B-703.

F. Raised Characters, CBC 11B-703.2: Raised characters shall comply with CBC Section 11B-703.2 and shall be duplicated in Braille complying with CBC Section 11B-703.3. Raised characters shall be installed in accordance with CBC 11B-703.4.

1. Depth: Raised characters shall be raised 1/32-inch minimum above their background.
2. Case: Raised characters shall be upper case.
3. Style: Raised characters shall be sans serif. Characters shall not be italic, oblique, script, highly decorative, or other unusual forms.
4. Character Proportions: Raised characters (Text) on signs shall be selected from fonts where the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.
5. Character Height: Character height measured vertically from the baseline of the character shall be of 5/8-inch minimum and 2-inches maximum based on the height of the uppercase letter “I”.
6. Stroke Thickness: Stroke thickness of the uppercase letter “I” shall be 15 percent maximum of the height of the character.
7. Character Spacing: Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spacing between individual raised characters shall be 1/8 inch minimum and 4 times the raised character stroke width maximum. Where characters have other cross sections, spacing between individual raised characters shall be 1/16 inch minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and 1/8 inch minimum and 4 times the raised character ma stroke width

maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8 inch minimum.

8. Line Spacing: Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.
9. Format: Text shall be in a horizontal format.
10. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background. Requirement applies to all signs.

G. Braille, CBC 11B-703.3: Braille shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4.

1. Dimensions and Capitalization (CBC 11B-703.3.1): Braille dots shall have a domed or rounded shape and shall comply with CBC Table 11B-703.3.1. The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms. Braille dot physical requirements shall be per CBC Table 11B-703.3.1 as indicated below; dimensions for distances are measured from center to center of Braille dots:

    a. Dot Base Diameter: 0.059 inch minimum, 0.063 inch maximum.
    b. Distance between Two Dots in the same Cell: 0.100 inches.
    c. Distance between corresponding Dots in adjacent Cells: 0.300 inches.
    d. Dot Height: 0.025 inch minimum, 0.037 inch maximum.
    e. Distance between corresponding Dots from one cell directly below: 0.395 inch minimum, 0.400 inch maximum.

2. Position (CBC 11B-703.3.2): Braille shall be positioned below the corresponding text in a horizontal format, flush left, or centered. If text is multi-lined, Braille shall be placed below the entire text. Braille shall be separated 3/8 inch minimum and 1/2 inch maximum from any other tactile characters and 3/8 inch minimum and from raised borders and decorative elements.

H. Sign Installation Height and Location, CBC 11B-703.4:

1. Height Above Ground or Floor: Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest Braille cells and 60 inches maximum above the finish floor or ground surface, measured form the baseline of the highest line of raised characters.
2. Location: Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leafs, the sign shall be located to the right of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches minimum by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing

between the closed position and 45 degree open position. Where provided, signs identifying permanent rooms and spaces shall be located at the entrance to, and outside of the room or space. Where provided, signs identifying exits shall be located at the exit door when approached in the direction of egress travel.

I. Visual Characters, CBC 11B-703.5: Visual characters are considered to be intended for signage that is not accompanied by Braille. (The requirements of this Section do not apply to room identification signage).

1. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background. Requirement applies to all signs.
2. Case: Characters shall be upper case or lower case or a combination of both.
3. Style: Characters shall be conventional in style. Characters shall not be italic, oblique, script, highly decorative, or other unusual forms.
4. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.
5. Character Height: Minimum character height shall be based on the uppercase letter “I” and shall comply with CBC Table 11B-703.5.5 as follows:

    a. Height of baseline of character from finish floor:

        1) 40 inches minimum to less than or equal to 70 inches with a horizontal viewing distance of:

            a) Less than 72 inches: Minimum character height to be 5/8 inch.
            b) 72 inches and Greater: Minimum character height to be 5/8 inch plus 1/8 inch for each foot of viewing distance beyond 72 inches.

        2) Greater than 70 inches to less than or equal to 120 inches with a horizontal viewing distance of:

            a) Less than 180 inches: Minimum character height to be 2 inches.
            b) 180 inches and Greater: Minimum character height to be 2 inches plus 1/8 inch for each foot of viewing distance beyond 180 inches.

        3) Greater than 120 inches, with a horizontal viewing distance of:

            a) Less than 21 feet: Minimum character height to be 3 inches.
            b) 21 feet and Greater: Minimum character height to be 3 inches plus 1/8 inch for each foot of viewing distance beyond 21 feet.

6. Height from Finish Floor or Ground: Visual characters shall be 40 inches minimum above the finish floor or ground measured to the baseline of the character.

7. Stroke Thickness: Stroke thickness of the uppercase letter “I” shall be 10 percent minimum and 20 percent maximum of the height of the character.
8. Character Spacing: Character spacing shall be measured between the two closest points of adjacent raised characters, excluding word spaces. Spaces between individual characters shall be 10 percent minimum and 35 percent maximum of character height.
9. Line Spacing: Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.
10. Format: Text shall be in a horizontal format.

J. Pictograms, CBC 11B-703.6:

1. Pictogram Field: Pictograms shall have a field height of 6 inches minimum. Characters and Braille shall not be located in the pictogram field.
2. Finish and Contrast: Pictograms and their field shall have a non-glare finish. Pictograms shall contrast with their field with either a light pictogram on a dark field or a dark pictogram on a light field.
3. Text Descriptors: Pictograms shall have text descriptors located directly below the pictogram field. Text descriptors shall comply with CBC Sections 11B-703.2, 11B-703.3, and 11B-703.4.

K. Symbols of Accessibility, CBC 11B-703.7:

1. Finish and Contrast: Symbols of accessibility and their background shall have a non-glare finish. Symbols of accessibility shall contrast with their background with either a light symbol on a dark background or a dark symbol on a light background.
2. Symbols:

    a. International Symbol of Accessibility (ISA): ISA symbols shall comply with CBC Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The blue shall be Color No. 15090 in Federal Standard 595B.
    b. International Symbol of Teletypewriter (TTY): The International Symbol of Teletypewriter (TTY) shall comply with CBC Figure 11B-703.7.2.2.
    c. Volume Control Telephones: Telephones with a volume control shall be identified with a pictogram complying with CBC Figure 11B-703.7.2.3.
    d. Assistive Listening Systems: Assistive listening systems shall be identified by the International Symbol of Access for Hearing loss complying with CBC Figure 11B-703.7.2.4.
    e. Toilet and Bathing Facilities, Geometric Symbols: Doorways leading to toilet and bathing rooms shall be identified by a geometric symbol complying with CBC Section 11B-703.7.2.6. The symbol shall be mounted at 58 inches minimum and 60 inches maximum above the finish floor measured from the centerline of the symbol. Where a door is provided, the symbol shall be mounted within 1 inch of the vertical centerline of the door.

        1) Men’s Toilet and Bathing Facilities: Men’s toilet and bathing facilities shall be identified by an equilateral triangle, 1/4 inch thick, with edges 12 inches long and a vertex pointing upward. The triangle symbol

shall contrast with the door, either light on dark background or dark on a light background.

2) Women's Toilet and Bathing Facilities: Women's toilet and bathing facilities shall be identified by a circle, 1/4 inch thick and 12 inches in diameter. The circle symbol shall contrast with the door, either light on dark background or dark on a light background.

3) Unisex Toilet and Bathing Facilities: Unisex toilet and bathing facilities shall be identified by a circle, 1/4 inch thick and 12 inches in diameter with a 1/4 inch thick triangle with a vertex pointing upward superimposed on the circle and within the 12 inch diameter. The triangle symbol shall contrast with the circle symbol, either light on dark background or dark on a light background, the circle symbol shall contrast with the door, either light on dark background or dark on a light background.

4) Edges and Corners: Edges of geometric symbols shall be rounded, chamfered, or eased. Corners of geometric symbols shall have a minimum radius of 1/8 inch.

2.2 MANUFACTURERS

A. Manufacturers, Basis-of-Design Products: In other Articles where named manufacturer's products are indicated, Drawings and Specifications are based on products manufactured by:

1. Best Sign Systems Inc.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) ASI-Modulex, Inc.
2) Gemini Incorporated.

2.3 PANEL SIGNS

A. General: Provide smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally from corner to corner complying with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

B. Design Requirements: Panel signs shall comply with Part 2 Article "Regulatory Requirements for Signs."

C. Scheduled Signs: Provide signs as indicated on Drawings and as scheduled in Part 3 Article "Sign Schedule."

D. Interior Panel Signs: Basis of Design: Best Sign Systems, Inc., HC 300 Series signs complying with the following requirements:

1. Material: Best Sign Systems Inc., MP Plastic, phenolic-backed melamine plastic laminate faced sheet, 0.25-inch thick.
2. Material: Best Sign Systems Inc., fiberglass Sheet, 0.25-inch thick.
3. Edge Condition: Beveled.
4. Corner Condition: Rounded to radius of 1/2 inch.
5. Border: 3/8-inch wide.
6. Text Font: Standard Medium.
7. Text Height: As indicated on Drawings.
8. Mounting: Unframed, wall mounted.
9. Color: As selected by Architect from manufacturer's full range, text and border shall contrast with background.

E. Exterior Panel Signs: Basis of Design: Best Sign Systems, Inc., HC 300 Series signs complying with the following requirements:

1. Material: Fiberglass Sheet, 0.25-inch thick.
2. Edge Condition: Beveled.
3. Corner Condition: Rounded to radius of 1/2 inch.
4. Border: 3/8-inch wide.
5. Text Font: Standard Medium
6. Text Height: As indicated on Drawings.
7. Mounting: Unframed, wall mounted.
8. Color: As selected by Architect from manufacturer's full range, text and border shall contrast with background.

F. Sign Backs/Blanks: Provide matching sign blanks for signs mounted to transparent and/or semi-transparent glazed surfaces to conceal exposed sign backs.

1. Where sign backs/blanks are located within the interior of the building, signs shall be of the same material as other interior signs.
2. Where sign backs/blanks are located on the exterior of the building, signs shall be of the same material as other exterior signs.
3. Profile and size of sign backs/blanks shall match that of the sign backs that are to be concealed.

2.4 ACCESSORIES

A. Mechanical Fasteners: Use tamper resistant fasteners fabricated from materials that are not corrosive to sign material and mounting surface.

B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.

1. Install signs level, plumb, and with sign surfaces free from distortion and other defects in appearance.
2. Install signs at locations required by regulatory requirements, as indicated on the Drawings, and per this Specification section.

B. Height: Install signs at heights indicated on Drawings and to comply with regulatory requirements indicated in Part 2 Article “Regulatory Requirements for Signs” of this specification Section.

1. Sign mounting height shall be consistent for the Project.

C. Location Relative to Door Openings: Install signs relative to door openings as indicated on Drawings and to comply with regulatory requirements indicated in Part 2 Article “Regulatory Requirements for Signs” of this specification Section.

1. Sign location relative to door openings shall be consistent for the Project.

D. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces that cannot be drilled or screwed. Do not use this method for vinyl-covered or rough surfaces.
2. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.
3. Mechanical Fasteners: Use non-removable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
4. Where panel signs are mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

B. Clean per manufacturer’s recommendation prior to final inspection.

3.4 SIGN SCHEDULE

A. Interior Room Identification Signs: Provide interior room identification signage adjacent to doors as indicated and scheduled on the Drawings.

1. Text Content: Identify rooms by number and name unless otherwise indicated. Room names and numbering shall comply with Owner’s instructions (not Architect’s referencing or numbering as indicated on the Drawings).
2. Text Height: As indicated on Drawings and in compliance with referenced CBC and ADA requirements.
3. Sign Size: As indicated on drawings.

B. Tactile Exit Signs: Provide tactile exit signs at locations indicated on Drawings, as required to comply with regulatory requirements, and as follows:

1. Exterior Doors: Each grade level exterior exit door from a room or space having an illuminated exit sign shall be identified by a tactile exit sign with the word “EXIT”.
2. Interior Rooms to Exits: Each exit door to a corridor, exit enclosure, or exit passageway, from a room having an illuminated exit sign shall be identified by a tactile exit sign with the words “EXIT ROUTE”.
3. Doors to Stairs and Ramps: Each exit door that leads directly to a grade-level exterior exit by means of a stairway or ramp shall be identified by a tactile exit sign with the following words as appropriate:

    a. EXIT STAIR DOWN.
    b. EXIT RAMP DOWN.
    c. EXIT STAIR UP.
    d. EXIT RAMP UP.

C. Toilet Room Identification Signs: Signage shall consist of door mounted geometric symbols and wall mounted identification signs to comply with regulatory requirements and as indicated on the Drawings.

D. Exterior Room/Space Identification Signs: Provide exterior identification signage at exterior public access doors to each usable or occupied space of the building.

1. Text Content: Identify building areas by functional use. Text content shall comply with Owner’s instructions.
2. Text Height: As indicated on Drawings and in compliance with referenced CBC and ADA requirements.
3. Sign Size: As indicated on drawings.

E. Vertical Platform Lift Signage: Signage as required to comply with regulatory requirements and as indicated on Drawings, located at lower landings, upper landings, and platform enclosure (3 locations per lift); sign information to include:

1. International Symbol of Accessibility.
2. Text stating: “NO FREIGHT”

END OF SECTION

SECTION 101410

CAST METAL PLAQUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Cast metal plaques.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, and full-scale template layout of characters and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish. Include manufacturer's information for selection of color, text height and style, background texture, border, edge details, mounting, and other pertinent data.

D. Sample Warranty: For special warranty.

E. Maintenance Data: For plaques to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate placement of backing for sign anchorage with wall framing.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.

b. Deterioration of embedded graphic image.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CAST METAL PLAQUES

A. Manufacturers: Subject to compliance with requirements, available manufacturers include but are not limited to the following:

1. ASI – Modulex.
2. Best Sign Systems Inc.
3. Gemini Incorporated.

B. Cast Metal Plaques: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Plaque Material: Cast aluminum.
2. Thickness: 0.25 inch.
3. Size: 24 inches wide by 18 inches high.
4. Background Texture: Manufacturer's standard stipple texture.
5. Borders and Text Finish: Satin.
6. Border Style: Integrally cast, raised, single line.
7. Mounting: Concealed studs.
8. Text and Typeface: Raised characters, text and typeface to be selected by Architect from manufacturer’s standard styles and sizes.
9. Copy: Allow one letter per each square inch of plaque.
10. Graphics: None.
11. Finish: Integral aluminum finish, clear anodized.
12. Finish: Integral metal finish, mil / antique oxidized / (various others)

2.2 MATERIALS

A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by plaque manufacturer for casting process used and for type of use and finish indicated.

B. Bronze Castings: ASTM B 584, lead-free alloy recommended by manufacturer and finisher for finish indicated.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. furnish stainless-steel devices unless otherwise indicated.
3. Plaque Mounting Fasteners: Concealed (blind), threaded studs welded, brazed, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.4 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Provide rabbets, lugs, and tabs necessary to attach to existing work. Drill and tap for required fasteners.
2. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Before installation, verify that mounting surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.

    a. Concrete and Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 CLEANING AND PROTECTION

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as plaques are installed.

C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions and touch up minor nicks and abrasions in finish.

Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 101419

DIMENSIONAL CHARACTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes cast aluminum dimensional sign characters and other characters with other materials indicated on drawings.

1.3 SUBMITTALS

A. Product Data: Manufacturer’s product data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale layout of characters and other components. Show mounting methods, layout, spacing, reinforcement, accessories, and installation details.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: Dimensional characters, full-size sample of each type of dimensional character for material, finish, color, size, and mounting indicated.

E. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 FIELD CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.5 COORDINATION

A. Coordinate location of backing for dimensional character anchorage with wall framing.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

A. Source Limitations: Obtain characters from a single source from a single manufacturer.

B. Cast Characters: Cast characters with smooth uniform faces, sharp corners, and precisely formed lines and profiles. Comply with the following requirements.

1. Manufacturer: Subject to compliance with requirements, provide products manufactured by one of the following:

a. ASI-Modulex, Inc.
b. Gemini Incorporated.
c. Metal Arts; Div. of L&H Mfg. Co.

2. Character Material: Cast Aluminum, ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
3. Character Height: As indicated on Drawings.
4. Thickness: Manufacturer’s standard for size of character.
5. Finish: Clear anodized.
6. Typeface: As selected by Architect from manufacturer’s standard font styles.
7. Text/Message: As indicated on Drawings.
8. Mounting: Concealed studs, lugs cast into back of characters and tapped to receive threaded mounting studs.

2.2 ACCESSORIES

A. Fastening Hardware: Manufacturer's standard as required for secure anchorage of characters, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Furnish stainless-steel devices.
3. Sign Mounting: Threaded studs with sleeve spacer, screwed into tapped lugs cast integrally into back of cast characters.

B. Adhesive: As recommended by sign manufacturer.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.3 FABRICATION

A. General: Provide manufacturer's standard cast characters as follows:

1. Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
2. Provide cast characters with rabbets, lugs, and tabs necessary to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match character finish unless otherwise indicated.
2. Stainless-Steel Brackets: Factory finish to match character finish unless otherwise indicated.

2.4 FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

E. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that character support surfaces are within tolerances to accommodate characters without gaps or irregularities between backs of characters and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Locate characters where indicated on Drawings, install characters using mounting methods indicated and according to manufacturer's written instructions.

1. Install characters level, plumb, true to line, and at locations and heights indicated, with character surfaces free of distortion and other defects in appearance.
2. Before installation, verify that wall surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Provide paper template showing proper character layout spacing and connection points for installation.

C. Projecting Stud Mounting: Using a template, drill holes in substrate aligning with studs on back of corresponding character. Remove loose debris from hole and substrate surface.

1. Cement Plaster, Concrete, and Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

3.3 CLEANING AND PROTECTION

A. Remove and replace damaged or deformed characters that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 102113
TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes solid-polymer plastic toilet compartments configured as toilet enclosures and urinal screens; floor anchored and overhead braced.

B. Related Sections:

1. Division 05 Section “Cold Formed Metal Framing” for backing and blocking for supports for toilet compartments.
2. Division 10 Section “Toilet Room Accessories” for toilet tissue dispensers, seat cover dispensers, grab bars, and similar accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include construction details, material descriptions, dimensions of individual components and profiles, hardware, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment material indicated.

D. Samples for Verification: Of each type of color and finish required for units, prepared on not less than 4-inch square Samples of same thickness and material indicated for Work.

E. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate blocking and backing for wall anchorage of toilet compartments with wall framing.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND REGULATORY REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

B. Accessible Compartments and Urinal Screens: Toilet compartments and urinal screens designated as being accessible to persons using wheelchairs shall comply with applicable provisions in the 2010 ADA Standards for Accessible Design, ICC/ANSI A117.1, and the 2022 California Building Code with latest Supplement(s).

1. Wheelchair accessible toilet compartments shall have minimum clear dimensions as follows:

a. Width: 60 inches.
b. Length: As required to provide the following clear spaces and/or clearances:

1) Clear Space from Rear Wall: Clear space measured from the rear wall; no doors may swing into this clear space, clear space shall include the water closet:

a) Wall Mounted Water Closets: 56 inches.
b) Floor Mounted Water Closets: 59 inches.

2) Clear space in front of water closets:

a) End opening stalls: 48 inches.
b) Side opening stalls: 60 inches.

3) Additional clearance as may be required for door pull side strike edge clearance.

c. Doors:

1) Clear Width:

a) End opening stalls: 32 inches.
b) Side opening stall: 34 inches.

d. Door Maneuvering Clearances, Location, and Hardware:

1) Pull Side Clearances:

a) Pull side strike edge clearance: 18 inches measured from the strike edge of the door in a closed position.
b) Pull Side Clearance Perpendicular to Door: 60 inches from the door in a closed position.

2) Push Side Clearance Perpendicular to Door: 48 inches from the face of the door in a closed position.
3) Maximum distance from edge of door opening to adjacent intersecting wall or partition panel: 4 inches.
4) Doors located at end opening stalls shall be located in front of the open space adjacent to the side of the water closet.
5) Door Operating Hardware:

a) Doors shall be self-closing (gravity hinge).
b) An accessible pull shall be located on each side of the door near the latch.
c) Operating hardware and pulls shall be located between 34 and 44 inches above the floor.
d) Operable hardware shall be operable with one hand and not require tight grasping, pinching, or twisting of the wrist. The force to operate hardware shall not exceed a 5 pound force.

e. Toe Clearance: Partitions shall have toe clearance of 12 inches minimum measured from the floor to the bottom of partition panels, exclusive of support members.
f. Accessible Route to Compartments: 44 inches.

2. Screens at Wheelchair Accessible Urinals: 30 inches minimum clear width, 36 inches minimum clear width where adjacent walls or screens are more than 24 inches deep.

2.2 SOLID POLYMER TOILET COMPARTMENTS AND SCREENS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Accurate Partitions Corporation.
2. General Partitions Mfg. Corp.
3. Scranton Products (Capitol/Comtec/Santana).

B. Toilet Enclosure Style: Floor anchored, overhead braced.

C. Urinal Screen Style: Wall hung.

D. Doors, Panels, and Pilasters: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch thick, seamless, and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range of colors and patterns.

2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip fastened to exposed bottom edges of solid-polymer doors and panels to prevent burning.

E. Pilaster Shoes: Manufacturer's standard design; stainless steel, 3-inches high.

F. Wall Brackets for Compartments: Manufacturer's continuous full height aluminum with bright dipped anodized finish wall brackets.

1. Profile: Double-ear profile unless single-ear, U-shaped or H-shaped profile is required for project conditions.

G. Wall Brackets for Urinal Screens: Heavy duty brackets fabricated from 0.075-inch thick (14 gage) stainless steel, double ear configuration, with braced 4-inch legs for 1-inch thick panels, “Jacknob” .No. 4439 or equivalent.

H. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in bright dipped anodized finish.

1. Wall Brackets for Headrails: 16 gage stainless steel.
2. End caps for Headrails: Manufacturer’s standard aluminum caps.

I. Floor Supports: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

J. Fasteners: All fasteners shall be stainless steel. Exposed fasteners shall have theft-resistant-type heads. Provide sex-type bolts for through-bolt applications.

1. Fasteners for Floor and Wall Connections:

a. Wood Framed Walls: No. 14 wood screw by length required to penetrate 2-inches into wood framing.
b. Metal Stud Framed Walls: No. 14 self-tapping sheet metal screw by length required to penetrate 1-inch beyond metal framing.
c. Concrete or Masonry Floors and Walls: Self-threading type masonry screws installed into pre-drilled holes, Hilti Kwik-Con II or equivalent, 1/4-inch diameter by 2-3/4 inches long with Torx hex washer head, stainless steel.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories as follows:

1. Hinges: Heavy duty extruded aluminum hinges, 8-inches in length, with wrap-around flanges, through bolted to pilasters and door panels with sex bolts. Hinges shall be self-closing type (gravity hinge) that can be adjusted to hold doors open at any angle up to 90 degrees. Self-closing at accessible stalls.
2. Latch and Keeper: Surface-mounted heavy duty extruded aluminum latch and keeper unit designed for emergency access and with combination rubber-faced

door strike and keeper secured to doors and panels with sex bolts. Strikes shall be a minimum of 6-inches long. Slide bolts shall have a black anodized finish.

a. Accessible Stalls: Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to persons with disabilities. Latches shall be flip-over style, sliding, or other hardware not requiring the user to grasp or twist.

3. Door Bumpers and Coat Hooks:

a. In-Swinging Doors: Manufacturer's standard chrome plated Zamac rubber-tipped combination coat hook and bumper, sized to prevent door from hitting compartment-mounted accessories, wall, or partition; 4 inch maximum projection; provide one at each inswinging door.
b. Out-Swinging Doors: Coat hook only, 1-1/2 inch maximum projection, mount at 46 inches maximum above the floor on the stall side of the door; Bobrick B-233 or equivalent.

4. Door Pulls: Manufacturer's standard chrome plated Zamac door pulls.

a. Out-swinging Doors: Provide door pulls on the pull side of out-swinging compartment doors.
b. Accessible Stalls and Ambulatory Accessible Stalls: Provide an accessible door pull on each side of doors near the latch at compartments indicated to be accessible to persons with disabilities. Door pulls shall be loop or U-shape complying with accessibility requirements of authorities having jurisdiction.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

C. Material Finishes, General: Provide hardware and accessories having the finishes indicated for the following materials:

1. Aluminum: Bright dipped anodized aluminum.
2. Stainless Steel: Satin finish.
3. Zamac: Chrome-plated, nonferrous, cast zinc alloy (zamac).

a. Zamac shall only be allowed for pulls, door bumpers, and combination coat hook/door bumpers.

2.4 FABRICATION

A. General: Provide panels of sizes indicated and as required for project conditions. Machine edges to have radius of 1/4-inch. Exposed panel surfaces shall be free of saw marks, cuts, nicks or other damage.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door and Panel Heights: Doors and panels shall be fabricated in 55-inch heights (Bottom of panel to top of panel).

D. Pilaster Heights: 82-inches.

E. Urinal Screens: Urinal screens shall be fabricated in 50-inch panel heights by 21-inches in depth.

F. Continuous Wall Brackets: Continuous wall brackets shall be cut to lengths one-inch less than panel heights.

G. Door Size and Swing: Unless otherwise indicated, provide doors as follows:

1. Standard, Non-Accessible Stalls: 24-inch wide in-swinging doors.
2. Wheelchair Accessible Stalls: 36-inch wide doors with a minimum 34-inch wide clear opening; doors shall be in-swinging or out-swinging as indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.
2. Accurately measure toilet rooms receiving compartments and locations of fixtures.

B. Proceed with installation only after unsatisfactory conditions have been corrected; commencement of work constitutes acceptance of conditions.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices in compliance with the specifications.

1. Maximum Clearances:

a. Pilasters to Panels: 1/2 inch.
b. Panels to Walls: 1 inch.

2. Comply with referenced regulatory requirements for compartments and screens to be installed at water closets and urinals indicated to be accessible.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than two fasteners. Head rails shall be cross braced with intersecting head rails spaced not more than 6 feet on center and aligned with the panels below. Install doors and panels with top edges level and aligned, adjust doors so tops of doors are parallel with overhead bracing when doors are in a closed position. Doors, panels and screens shall be installed with the bottom edge approximately 14-inches above the floor (approximate dimension for accommodation of floor slope).

C. Wall-Hung Urinal Screens: Attach screens to wall with 3 wall heavy duty urinal screen wall brackets located at top, bottom, and mid-panel. Set units level and plumb and to resist lateral impact.

1. Mounting of urinal screens shall comply with 2022 CBC Section 1209.3.2:

a. Bottom of Screen from Floor: 12 inches maximum.
b. Top of Screen from Floor: 60 inches minimum.
c. Projection from Wall: 18 inches minimum and not less than 6 inches minimum beyond the outermost lip of the urinal.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges to return doors to a fully closed position unless otherwise noted. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched.

END OF SECTION

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SECTION 102600
WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Stainless steel corner guards.

B. Related Sections:

1. Division 08 Section "Door Hardware" for metal armor, kick, mop, and push plates for doors.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Store products either in a vertical or horizontal position as indicated by the manufacturer.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of wall protection products from a single source from a single manufacturer.

2.2 STAINLESS STEEL GUARDS

A. Corner Guards, Stainless Steel, Surface-Mounted: Fabricated as one-piece from formed metal with formed edges with 90 or 135-degree turn to match wall condition.

1. Material: Stainless steel, Type 304.
    a. Thickness: Minimum 0.0625 inch.
    b. Finish: Directional satin, No. 4.
2. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
3. Length: 48 inches.
4. Corner Radius: 1/8 inch.
5. Edges: Beveled.
6. Mounting: Oval head, countersunk screws through factory-drilled mounting holes.

B. End Wall Guards, Stainless Steel, Surface-Mounted: Fabricated as one-piece from formed metal, U-shaped with formed edges that covers entire end of wall.

1. Material: Stainless steel, Type 304.
    a. Thickness: Minimum 0.0625 inch.
    b. Finish: Directional satin, No. 4.
2. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
3. Length: 48 inches.
4. Corner Radius: 1/8 inch.
5. Edges: Beveled.
6. Mounting: Oval head, countersunk screws through factory-drilled mounting holes.

2.3 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.4 FABRICATION

A. Fabricate wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire ratings, and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting and priming, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install wall protection products according to manufacturer’s written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

END OF SECTION

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SECTION 102800
TOILET ROOM ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following:

1. Toilet room and miscellaneous sink accessories.
2. Diaper Changing Stations.
3. Custodial accessories.
4. Underlavatory and undersink guards.

B. Related Sections:

1. Division 05 Section “Cold Formed Metal Framing” for backing and blocking for supports for toilet compartments.
2. Division 10 Section “Toilet Compartments” for toilet accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

C. Sample Warranty: For manufacturer's special warranty.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

C. Coordinate backing for mounting accessories with wall framing.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 (ten) years from date of Substantial Completion as indicated in the Accessory schedule at the end of the Section.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Regulatory Requirements: Toilet room accessories and mounting heights of accessories to be used by persons with disabilities shall comply with accessibility requirements of the 2010 ADA Standards for Accessible Design and the 2022 California Building Code, Chapter 11B, “Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.”

B. Installation: Where accessories are to be usable by persons with disabilities, comply with regulatory requirements including, but not limited to the following:

1. Where accessories are provided, at least one of each type shall be accessible.
2. Accessories shall be located on an accessible route.
3. The height above the floor to any operating mechanism or point of use shall not exceed 40-inches.
4. Accessories shall not obstruct the use of grab bars for a minimum distance of 12 inches above and 1-1/2 inches below grab bars.
5. Accessories located below 34 inches above the floor shall not project into the clear space required for any plumbing fixture.
6. Accessories with their bottom edge more than 27 inches above the floor shall not project more than 4 inches from the wall.

7. Mirrors located above lavatories or counter tops shall be installed with the bottom edge of the reflecting surface 40 inches maximum above the floor, mirrors not located above lavatories or counter tops shall be installed with the bottom edge of the reflecting surface 35 inches maximum above the floor.
8. Toilet paper dispensers shall not be of a type that controls delivery or that does not allow for continuous paper flow.

2.2 TOILET ROOM ACCESSORIES

A. Scheduled Accessories: Accessories are indicated and scheduled on the drawings.

1. Basis of Design: Named manufacturers' products indicated in the accessory schedule for each accessory type indicated are for the purpose of establishing minimum requirements. Named products are based on the following manufacturer:

a. Bobrick Washroom Equipment, Inc.

1) Subject to compliance with requirements, provide products indicated or equivalent products by one of the following:

a) American Specialties, Inc.
b) Bradley Corporation.
c) General Accessory Manufacturing Co. (GAMCO)

B. Locks and Keys: Lockable accessories shall be provided with cylindrical locks and all locks shall be keyed alike. Provide each lockable accessory with not less than one key.

C. Finish: Exposed stainless steel surfaces of accessories shall have a satin finish unless otherwise indicated.

2.3 DIAPER CHANGING STATIONS

A. Diaper Changing Stations: Horizontal unit that opens by manually folding down from a stored position and designed to support a minimum of 250 lb static load when opened.

1. Basis-of-Design Product: Drawings and Specifications are based on the following:

a. Koala Kare Products; Model KB-300 Horizontal Wall Mounted Baby Changing Station.

1) Subject to compliance with requirements, provide the named product or a comparable product subject to request for substitution.

2. Mounting: Surface mounted.
3. Projection from Wall: Not more than 4 inches from wall when closed, 24 inches maximum when open.
4. Width: 36 inches nominal.
5. Operation: Manually operated with pneumatic shock-absorbing mechanism for controlled opening and closing.

6. Material and Finish: Injection molded polypropylene having antimicrobial embedded into plastic material, in color selected by Architect from manufacturer's standard colors (Cream, gray, white, light brown).
7. Features and Accessories:
    a. Nylon safety strap at changing table.
    b. Integral hooks for bags or purses, not less than two.
    c. Built-in liner dispenser.
8. Standards: Diaper changing stations to comply with the following:
    a. ASTM F 2285 Standard Safety Performance Specification for Diaper Changing Tables for Commercial Use.
    b. ANSI Z535.4 Product Safety Signs and Labels.
9. Accessibility Requirements: Unit shall comply with requirements of the 2010 ADA Standards for Accessible Design and the 2022 California Building Code.
    a. Operable parts shall be operable with one hand and not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts or pull down the changing table shall not exceed 5 lbs.
    b. Knee and Toe Clearance: Width of 30 inches minimum, depth of 19 inches minimum/24 inches maximum, and vertical clearance of 27 inches minimum above the floor.
    c. Changing Table Height: 34 inches maximum above the floor.
    d. Reach Range: 48 inches maximum above the floor for forward reach range for hand holds to pull down the changing table, 40 inches maximum above the floor to dispenser outlets.

2.4 UNDERLAVATORY AND UNDERSINK GUARDS

A. Underlavatory and Undersink Guards:
1. Basis-of-Design Product: Drawings and Specifications are based on the following:
    a. Truebro, Inc., Lavguard2 series underlavatory guard.
        1) Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
            a) Plumberex Specialty Products, Inc.
2. Description: Antimicrobial, white molded-plastic underlavatory and undersink guard assemblies. Underlavatory and undersink guard assemblies shall cover waste piping and hot and cold water supply piping, allow service access without removing coverings, and shall prevent contact with hot surfaces and/or sharp objects.
3. Locations: Provide underlavatory and/or undersink guard assemblies at all lavatories and/or sinks with exposed water and drain lines in all toilet rooms, and at sinks in cabinets/counter tops that are indicated to be accessible to persons in a wheel chair.

2.5 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304 with satin finish, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel).

D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.
2. Confirm and coordinate mounting heights and locations of support backing for accessories that are to be accessible to persons with disabilities to insure installed accessories will comply with accessibility requirements when installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected; commencement of work constitutes acceptance of conditions.

3.2 INSTALLATION

A. Install accessories according to manufacturers' written instructions and as indicated on Drawings. Use fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Accessories mounted on walls within toilet compartments or within 2 feet of water closets, lavatories, sinks, urinals, or similar plumbing fixtures shall be installed with penetration of wall finishes sealed to protect structural elements within walls from moisture. Sealant shall not be visible in the finished installation. Sealant shall be mildew resistant silicone sealant as specified in Division 7 Section “Joint Sealants.”

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446. Where installed on toilet compartment partitions, provide backing plates and comply with requirements of DSA IR 16-12.

C. Diaper Changing Stations:

1. Changing Table Height: 34 inches maximum above the floor when deployed.
2. Knee Clearance: 27 inches minimum above the floor.
3. Changing tables located in multi-accommodation toilet rooms, when deployed, shall not obstruct the required width of accessible routes to other accessible fixtures or features within the room (Accessible routes shall be 44 inches minimum in width).
4. Changing tables shall not be located in toilet compartments of multi-accommodation toilet rooms.

3.3 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.4 ACCESORY LOCATIONS

A. General: Accessories shall be provided at locations indicated on drawings, for locations where accessories are not indicated, provide accessories as follows:

1. Paper Towel Dispensers: Provide one surface mounted paper towel dispenser for each single sink or lavatory location; where multiple sinks or lavatories occur in the same room or area, provide one towel dispenser for every 2 sinks or lavatories.

2. Soap Dispensers: Provide one surface mounted soap dispenser for each sink or lavatory.
3. Toilet Tissue Dispensers: Provide one surface mounted toilet tissue dispenser for each water closet.
4. Seat Cover Dispensers: Provide one surface mounted seat cover dispenser for each water closet.
5. Grab Bars: Provide one 42-inch grab bar at the back of the water closet and one 48-inch grab bar at the side of the water closet for all wheel chair accessible water closets.

END OF SECTION

SECTION 104116
EMERGENCY KEY CABINETS (KNOX BOX)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes emergency key cabinets (Knox Box).

1.3 SUBMITTALS

A. Product Data: For each type of product including installation instructions. Include roughing-in dimensions and details showing mounting method and relationships of box and trim to surrounding construction.

PART 2 - PRODUCTS

2.1 EMERGENCY KEY CABINETS

A. Emergency Key Cabinets, General: Emergency key cabinet for secure storage of keys for use by local police and fire departments. Emergency key cabinets shall be acceptable to local police and fire departments.

B. Basis of Design: Drawings and Specifications are based on the following:

1. Knox Company; 3200 Series Hinged Door Model Knox Box.

C. Emergency Key Cabinet Properties:

1. Mounting: Surface mounted or recessed as indicated on drawings.
2. Exterior Dimensions (Body): 4 inches high, by 5 inches wide, by 3-3/4 inches deep.
3. Lock: UL listed, double action rotating tumblers and hardened steel pins accessed by a biased cut key.
4. Body: 1/4 inch steel plate.
5. Door: 1/2 inch thick steel with interior gasket and stainless steel hinge.
6. Finish: Manufacturer’s standard proprietary finish.

    a. Color: Aluminum.

7. Capacity: Holds up to 10 keys and access cards.

8. Tamper Switch: Tamper switch for connection to building alarm system, UL listed switch if indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls for suitable framing depth and blocking where emergency key cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed emergency key cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. Location and Height: Install emergency key cabinets in locations and at mounting heights indicated, 6 ft high minimum mounting height unless restricted by local requirements; mounting locations and heights shall be acceptable to authorities having jurisdiction.

B. Installation: Install cabinets in accordance with cabinet manufacturer’s installation instructions appropriate for construction materials of project conditions. Installation shall be capable of resisting physical attack and preventing unwanted removal of cabinet.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust cabinet doors to operate easily without binding. Verify that locking devices operate properly.

C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by cabinet manufacturers.

E. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 104313

DEFIBRILLATORS AND CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Portable automated external defibrillator (AED) equipment.
2. Cabinets for automated external defibrillators.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and door style.

B. Shop Drawings: Include plans showing locations of cabinets and equipment.

C. Maintenance Data: For equipment and cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of cabinet to ensure that cabinet size will accommodate AED equipment and accessories.

B. Coordinate sizes and locations of cabinets with wall depths, wall framing, and blocking for anchorage of cabinets.

PART 2 - PRODUCTS

2.1 AUTOMATED EXTERNAL DEFIBRILLATOR (AED) EQUIPMENT

A. Basis of Design: Design, Drawings and Specifications are based on the following:

1. Philips Medical Systems; HeartStart OnSite AED, Model M5066A Automatic External Defibrillator.

a. No substitutions, product is based on Owner's established standard.

B. AED Description: portable, self-contained, battery powered AED.

1. Size: 2.8 inches deep x 7.4 inches high x 8.3 inches wide.
2. Weight: 3.3 lbs.
3. Batteries: 9 Volt DC, 4.2AH composed of disposable long-life lithium manganese dioxide primary cells

a. Capacity: Minimum 200 hsocks or 4 hours of operating time.
b. Standby Life: 4 years.

4. Pads: Adult size.
5. Cable Length: 54 inches

2.2 CABINETS FOR AUTOMATED EXTERNAL DEFIBRILLATORS

A. Basis of Design: Design, Drawings and Specifications are based on the following:

1. Phiips Medical Systems; Model PFE7023D Premium Semi-recessed and alarmed cabinet.

a. Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:

1) J. L. Industries, Inc., a division of Activar Construction Products Group.
2) Larsen's Manufacturing Company.
3) Potter Roemer LLC.

B. Cabinet Type: Semi-recessed Cabinet, size suitable for AED equipment, box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Cabinet Construction: Nonrated.
2. Cabinet Material: Steel sheet.
3. Wall Recess: Cabinet shall require wall recess of no more than 4 inches.
4. Projection from Wall: Cabinet, including trim and pull handles, shall not project more than 4 inches from the finished wall surface.

5. Inside Dimensions: Clear inside dimensions of 14 inches wide by 22 inches high by 3.5 inches deep, minimum.
6. Finish: Manufacturer's standard baked-enamel paint or powder coat finish for exposed and semi-exposed surfaces.

    a. Color: White.

C. Trim Style: Manufacturer’s standard rolled edge trim.

1. Material: Steel sheet matching cabinet.
2. Finish: Same as for cabinet.

D. Door Style: Manufacturer’s standard half-Glass and AED graphics/decal.

1. Door Material: Steel sheet.
2. Finish: Same as for cabinet.
3. Door Glazing: Acrylic or tempered glass.
4. AED Graphics: Manufacturer’s standard.
5. Door Hardware: Manufacturer’s standard.

    a. Pull: Manufacturer’s standard.
    b. Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
    c. Hinge: Provide continuous hinge, of same material and finish as trim permitting door to open 180 degrees.

E. Alarm: Manufacturer’s standard 85 db (audible) battery operated cabinet-mounted alarm to protect against theft or tampering; alarm deactivated when door is closed.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Glass: Tempered float glass, ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 FABRICATION

A. AED Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed AED cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install cabinets at locations indicated.

B. AED Cabinets: Fasten cabinets to structure, square and plumb.

1. Mounting Height: Mount cabinets so that the top of equipment access or any operable parts will not exceed 48 inches above the finished floor.

3.4 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by cabinet manufacturer.

E. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 104415

FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-fire rated fire extinguisher cabinets for portable fire extinguishers.
2. Portable hand carried multi-purpose dry chemical ABC rated fire extinguishers.
3. Portable hand carried wet chemical Type K rated fire extinguishers.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire extinguisher cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

C. Coordinate blocking and backing for wall anchorage of cabinets with wall framing.

1.5 WARRANTY

A. Special Warranty for Fire Extinguishers: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from a single source from a single manufacturer.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. J. L. Industries, Inc.; a division of Activar Construction Products Group.
2. Larsen's Manufacturing Company.
3. Potter Roemer LLC.

2.2 PORTABLE FIRE EXTINGUISHERS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers, General: Type, size, and capacity as indicated.

1. Valves: Manufacturer's standard.
2. Handles and Levers: Manufacturer's standard.
3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

C. Multipurpose Dry-Chemical ABC Extinguisher: UL-rated, 5-lb, 2-A:10B:C, nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

1. Provide at locations where fire extinguishers or fire extinguisher cabinets are indicated except in Kitchens.

D. Wet-Chemical Type K Extinguishers: UL-rated 2-A:1-B:C:K, 1.6-gal. nominal capacity, with potassium acetate-based chemical in stainless steel container; with pressure-indicating gage.

1. Provide one wet-chemical type fire extinguisher in the kitchen in cooking areas indicated on the drawings and in locations required by local Fire Department.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Fire extinguisher manufacturer’s standard galvanized steel bracket designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with red baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words “FIRE EXTINGUISHER” in red letter decals applied to mounting surface.

a. Orientation: Vertical.

2.4 FIRE EXTINGUISHER CABINETS

A. Cabinet Type: Semi-recessed cabinet with box partially recessed in walls of sufficient depth suitable for fire extinguishers indicated, with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Cabinet Size: Cabinet shall be of a size to accommodate a 10 lb fire extinguisher.
2. Cabinet Construction: Nonrated.
3. Cabinet Material: Cold-rolled steel sheet.
4. Wall Recess: Cabinet shall require of wall recess of no more than 5 inches.

B. Doors and Trim:

1. Trim Style: Rolled edge trim with 1-1/2-inch or 2-1/2-inch backbend depth as standard with manufacturer.

a. Projection from Wall: Cabinet, including trim and pull handles, shall not project more than 4 inches from the finished wall surface.

2. Material (Doors and Trim): Cold-rolled steel sheet.
3. Doors:

a. Style: Vertical duo panel with frame, duo panel adjacent to strike edge of door.
b. Door Glazing: Tempered float glass (clear).
c. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1) Latch and Pull: Manufacturer’s standard projecting door pull and friction latch.
2) Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.

3) Hinge: Manufacturer’s standard continuous hinge, of same material and finish as trim permitting door to open 180 degrees.

C. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

D. Identification: Identify fire extinguishers in fire protection cabinets with the words “FIRE EXTINGUISHER” applied to the door.

1. Lettering shall comply with authorities having jurisdiction for letter style, size, spacing, and location.
2. Lettering Application Process: Silk screened or pressure sensitive vinyl letters.
3. Lettering Color: Red.
4. Lettering Orientation: Vertical.

E. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

a. Finish: Manufacturer’s standard baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Color: White.

2. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet, clear anodic finish.
3. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.5 FABRICATION OF FIRE PROTECTION CABINETS

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.6 GENERAL FINISH REQUIREMENTS FOR CABINETS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged fire extinguishers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire extinguishers, cabinets, and mounting brackets in locations indicated, and in compliance with requirements of authorities having jurisdiction.

B. Fire Extinguisher Cabinets: Fasten cabinets to structure, square and plumb.

1. Mounting Brackets: Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
2. Mounting Height: Mount cabinets and brackets so that the top of installed fire extinguishers will not exceed 48 inches above the finished floor.

C. Bracket Mounted Fire Extinguishers: Fasten mounting brackets to surfaces, square and plumb.

1. Mounting Height: Mount brackets so that the top of installed fire extinguishers will not exceed 48 inches above the finished floor, and the bottom of extinguishers will not be more than 26-1/2 inches above the floor.

D. Identification: Apply identification lettering at locations indicated or as required by authorities having jurisdiction.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 105113
METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Knocked-down metal lockers as indicated on drawings.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and locker identification system.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For metal lockers in manufacturer's standard sizes.

E. Qualification Data: For Installer.

F. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:

1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
2. Recessed openings.
3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of bases, framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures.
    b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Knocked-Down Metal Lockers: Three years from date of Substantial Completion.
4. Warranty Period for All-Welded Metal Lockers: Lifetime years from date of Substantial Completion.

B. Manufacturer and Supplier shall provide the Owner a warranty upon delivery of lockers that warrants parts and accessories will be made available to the Owner in the future at no additional surcharge or retooling charge.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

1. Obtain locks from single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the 2010 ADA Standards for Accessible Design and the 2022 California Building Code, Chapter 11B.

1. Vertical Reach Range:

a. High Reach: The highest shelf or hook of an accessible locker shall not be more than 48-inches above the floor surface.
b. Low Reach: The locker bottom or lowest shelf of an accessible locker shall not be less than 15-inches above the floor surface.

2. Operating Hardware: Operating hardware shall be located within the vertical reach ranges and shall not require tight grasping, pinching, or twisting of the wrist, and shall operate with a force of not more than 5 lbf. Provide a minimum of two accessible lockers or as indicated.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS) Type B, suitable for exposed applications.

B. Expanded Metal: ASTM F 1267, Type II (flattened), Class I, 3/4-inch steel mesh, with at least 70 percent open area.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

D. Extruded Aluminum: ASTM B 221, alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.

E. Steel Tube: ASTM A 500, cold rolled.

F. Fasteners: Zinc or nickel-plated steel, slotless-type exposed bolt heads and self-locking nuts or lock washers for nuts on moving parts.

G. Anchors: Select material, type, size, and finish required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.4 SCHEDULED LOCKERS

A. General: Provide lockers and accessories complying with requirements in this Section and as indicated in Part 3 Article "LOCKER SCHEDULE.”

2.5 KNOCKED DOWN METAL LOCKERS

A. Basis-of-Design Product: Drawings and Specifications are based on the following:

1. List Industries Inc.; Superior Classic KD Lockers.

    a. Subject to compliance with requirements, provide either the named product or a comparable product by one of the following manufacturers:

        1) Art Metal Products, Div. of Fort Knox Storage Co.
        2) DeBourgh Mfg. Co.
        3) Lyon Workspace Products.
        4) Penco Products, Inc., Subsidiary of Vesper Corporation.

B. Locker Arrangement: As indicated on Drawings.

C. Material: Cold rolled steel sheet.

D. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated, steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Intermediate Dividers: 0.024 inch (24 gage) nominal thickness, with single bend at sides.
2. Backs and Sides: 0.024 inch (24 gage) nominal thickness, with full-height, double-flanged connections.
3. Shelves: 0.024 inch (24 gage) nominal thickness, with double bend at front and single bend at sides and back.

E. Frames: Channel formed frames fabricated from 0.060-inch (16 gage) nominal thickness, steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical frame members.

F. Doors: One piece; fabricated from 0.060-inch (16 gage) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Doors less than 12 inches wide may be fabricated from 0.048-inch (18 gage) nominal-thickness steel sheet.
2. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
3. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (18 gage) nominal-thickness steel sheet; welded to inner face of doors.
4. Door Style: As indicated in Part 3 Article “Locker Schedule.” Door styles may include the following:

5. Door Style: Vented panel as follows:

    a. Louvered Doors: Fabricate with not less than six louver openings at top and bottom for single-tier, three louver openings at top and bottom for double-tier, and two or three louver openings at top and bottom for triple-tier lockers.

G. Hinges: Manufacturer’s standard continuous 16 gage steel piano hinge welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

H. Door Handle and Latches: As indicated in Part 2 Article “Latches” and Part 3 Article “Locker Schedule.”

I. Locks: As indicated in Part 2 Article “Latches” and Part 3 Article “Locker Schedule.”

J. Steel Sheet Finish: As indicated in Part 2 Article “Steel Sheet Finish” and Part 3 Article “Locker Schedule.”

K. Accessories: As indicated in Part 2 Article “Equipment and Accessories” and Part 3 Article “Locker Schedule.”

2.6 LATCHES

A. General: Provide latches complying with requirements in this Section and as indicated in Part 3 Article "LOCKER SCHEDULE.”

B. Projecting Operable Door Handle and Latch: Manufacturer's standard, finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic, prelocking, pry resistant; chromium-plated, vandal-resistant, lift-up handle.

1. Latch Hooks: Equip [doors 48 inches and higher with 3 latch hooks and doors less than 48 inches high with 2 latch hooks; fabricated from minimum 0.0966-inch thick steel; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
2. Latching Mechanism: Manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

C. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.

1. Multipoint Latching for Built-in Locks: Finger-lift latch control designed for use with built-in combination locks, built-in cylinder locks, or padlocks; positive automatic and prelocking.

a. Latch Hooks: Equip doors 48 inches and higher with 3 latch hooks and doors less than 48 inches high with 2 latch hooks; fabricated from minimum 0.1116-inch thick steel; welded to full-height door strikes; with resilient silencer on each latch hook.
b. Latching Mechanism: Manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be

locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

2. Single-Point Latching for Built-in Locks: Nonmoving latch hook designed to engage bolt of built-in combination or cylinder lock.

    a. Latch Hook: Equip each door with 1 latch hook, fabricated from minimum 0.1116-inch thick steel; welded midway up full-height door strike; with resilient silencer.

3. Single-Point Latching for Padlocks: Nonmoving latch hook with steel padlock loop that projects through recessed cup and is finished to match metal locker body.

    a. Latch Hook: Equip each door with 1 latch hook, fabricated from minimum 0.1116-inch thick steel; welded midway up full-height door strike; with resilient silencer.

D. Projecting Fixed Door Handle and Latch: Steel finger pull with steel padlock loop that projects through metal locker door. Provide padlock strike plate to protect door finish from contact with padlock.

2.7 LOCKS

A. General: Provide locks complying with requirements in this Section and as indicated in Part 3 Article “LOCKER SCHEDULE.”

B. Padlocks: Provided by Owner.

C. Built-in Combination Locks: Key-controlled, three-number dialing combination locks with 50-number divisions, tamper proof case, stainless steel escutcheon, rust resistant mechanism, lifetime lubrication; spring bolt operation, and with 5 pre-set combinations that can be changed with a touch of a button.

1. Master Lock Company, model 1254 or 1655 as required for right or left hand door opening.

D. Cylinder Locks: Built-in, flush locks with five-pin tumbler keyway and spring bolt operation, keyed separately and master keyed. Furnish two change keys for each lock and five master keys.

1. Master Lock Company, model 1714 series key locks.

    a. Provide ADA series keys at lockers indicated to be accessible to persons with physical disabilities.

2.8 EQUIPMENT, AND ACCESSORIES

A. Identification Plates: Equip each metal locker with Manufacturer’s standard aluminum identification plate with letter/number characters not less than 3/8-inch high.

Identification plates shall be located near the tops of doors and be fastened to doors with rivets.

1. Locker Identification Schedule: Provide locker identification as indicated in Part 3 Article "LOCKER IDENTIFICATION SCHEDULE."

B. Hooks and Coat Rods: Equip each metal locker with the following, unless otherwise indicated:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
3. Triple-Tier Units: One double-prong ceiling hook.
4. Coat Rods: As indicated on Drawings.

C. Accessories:

1. General: Provide Accessories complying with requirements in this Section and as indicated in Part 3 Article "Locker Schedule."
2. Legs: Where legs are indicated, provide legs 4 inches high; which are extensions of locker frames with closed fronts and ends fabricated from 0.0428-inch (18 gage) thick, cold-rolled steel sheet

3. Continuous Metal Base: Where a continuous metal base is indicated, provide a **6 inch** high 'Z' or 'C' channel base fabricated from 0.0677-inch (14 gage) thick, cold-rolled steel sheet.
4. Continuous Sloping Tops: Lockers that are not built into surrounding wall construction shall have continuous sloping tops fabricated from minimum 0.0428-inch (18 gage) thick, cold-rolled steel sheet; approximately 20-degree pitch. End closures shall be vertical.
5. Recess Trim: Where recessed trim is required, fabricate trim from 0.0428-inch (18 gage) thick, cold-rolled steel sheet.
6. Filler Panels: Where filler panels are required, fabricate from 0.0528-inch (16 gage) thick, cold-rolled steel sheet.
7. Boxed End Panels: Exposed ends of lockers shall have boxed end panels fabricated from 0.0528-inch (16 gage) thick, cold-rolled steel sheet.

2.9 FABRICATION

A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.

B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Knocked-Down Construction: Fabricate metal lockers for nominal assembly at Project site using nuts, bolts, screws, or rivets. Factory weld frame members together to form a rigid, one-piece assembly.

D. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections, with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.

E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

F. Coat Rods: Fabricated from 1-inch diameter steel; chrome or nickel plated finish.

G. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch high.

H. Legs: Where legs are required, provide legs by extending vertical frame members or by attaching gusset-type legs to locker body; with provision for fastening to floor; finished to match lockers.

1. Closed Front and End Bases: Fabricate bases without overlap or exposed fasteners; finished to match lockers.

I. Continuous Base: Formed into channel or Z profile for stiffness, and fabricated in lengths as long as practicable to enclose base and base ends of metal lockers; finished to match lockers.

J. Continuous Sloping Tops: Lockers that are not built into surrounding wall construction shall have continuous sloping tops. Fabricate continuous sloping tops in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers.

1. Where multiple runs of lockers meet at right angles, provide mitered sloped top corner fillers.

K. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practicable; finished to match lockers.

L. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.

M. Boxed End Panels: Fabricated with 1-inch wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.10 STEEL SHEET FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

D. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

1. Color(s): As selected by Architect from manufacturer's full range; doors and frames of matching colors, with one color for each room or area.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches on center. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion,.
2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Metal Lockers: Assemble knocked-down metal lockers with standard fasteners, with no exposed fasteners on door faces or face frames.

C. All-Welded Metal Lockers: Connect groups of all-welded metal lockers together with standard fasteners, with no exposed fasteners on face frames.

D. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.

2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify lockers as indicated in Part 3 Article "Locker Identification Schedule."

   a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
   b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

4. Attach recess trim to recessed metal lockers with concealed clips.
5. Attach filler panels with concealed fasteners. Locate fillers panels where indicated on Drawings.
6. Attach sloping top units to metal lockers, with closures at exposed ends.
7. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

3.4 LOCKER SCHEDULE

A. Locker Type – As indicated on drawings.

1. Use and Location: **Kitchen Staff Lockers.**
2. Construction: **Knocked-down, Flat top.**
3. Door Style: Louvered.
4. Latching: **Recessed handle and latch, single point latching for pad lock.**
5. Locking: Padlock by Owner.
6. Base: **Continuous 'Z' channel.**
7. Accessories: One shelf & two hooks, each locker.
8. Baked enamel finish.

3.5 LOCKER IDENTIFICATION SCHEDULE

A. Rooms containing 1 to 898 lockers, identify lockers with a 3 digit numbering system starting with the number 101. The numbering sequence shall be top to bottom, left to right.

1. Identification of disabled Access Lockers: Locker identification plates for lockers identified to be accessible shall have numbers preceded by the letter ‘H.’

END OF SECTION

SECTION 107113
EXTERIOR SUN CONTROL DEVICES (BRISE SOLIEL)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes exterior sun control devices of rectangular aluminum tube sections.

B. Related Sections:

1. Division 05 Sections "Structural Steel Framing" and “Metal Fabrications” for steel framed supports supporting exterior sun control devices.

1.3 SUBMITTALS

A. Product Data: For exterior sun control devices; include material descriptions, dimensions and profiles of individual components, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Qualification Data: For installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for exterior sun control devices by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 EXTERIOR ALUMINUM SUN CONTROL DEVICES (BRISE SOLIEL)

A. Basis-of-Design Manufacturer: Design, Drawings and Specifications are based on products by:

1. Architectural Grilles and Sunshades, Inc. (AGS).

a. Subject to compliance with requirements, provide products by manufacturer indicated or comparable products by one of the following:

1) Active Glass Industries.
2) Pittco Architectural Metals.

B. Source Limitations: Obtain all components of exterior sun control devices from a single source from a single manufacturer.

C. Exterior Aluminum Sun Control Devices (Brise Soliel):

1. Vertical Fins:

a. Material: Extruded aluminum tubing, 6063-T5.
b. Size: 2 inches by 12 inches.
c. Wall Thickness: As determined by manufacturer.
d. Length: As indicated on Drawings.
e. Finish: Clear anodized.

2. End Caps: Extruded aluminum plate, 6063-T5, 1/4 inch thickness.
3. Brackets: Extruded aluminum angles, 6063-T5, 3 inches by 6 inches by 1/4 inch thickness, length and spacing as required for project conditions.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

E. Fasteners: Non-magnetic stainless steel, 300 Series, ASTM A-307, Grade A or better.

F. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.2 MATERIALS

A. General: Materials shall be free from defects impairing strength, durability or appearance.

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209, Alloy 5052-H32 or greater.

2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221, Alloy 6063-T5 and 6063-T6.
3. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

2.3 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Shop Assembly: Preassemble components in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.4 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.7 mils (0.018 mm) or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structure, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install exterior sun control devices as indicated on Drawings, approved Deferred Submittal Drawings, and in compliance with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Metal Protection: Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.

E. Install components plumb and true in alignment with established lines, and without warp or rack.

3.3 ERECTION TOLERANCES

A. Install exterior sun control devices to comply with the following maximum erection tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

3.4 CLEANING AND PROTECTION

A. Cleaning: Clean surfaces to prevent buildup of dust and debris; clean in accordance with manufacturer’s cleaning instructions.

B. Protection: Protect exterior sun control devices to prevent damage for the remainder of the construction period.

END OF SECTION

SECTION 110113
OWNER FURNISHED CONTRACTOR INSTALLED EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Contractor installation of Owner furnished equipment and appliances, including building utility service connections. Owner furnished Contractor installed (OFCI) equipment and appliances shall be as indicated on the Drawings.

a. The Work shall include receiving, unloading, handling, storing, protecting, and installing Owner-furnished equipment and appliances, making building services connections and anchoring equipment to floors and walls as indicated in drawings and manufacturers written instructions.

B. Related Sections:

1. Division 22 through 26 Sections for applicable Plumbing, Mechanical, and Electrical requirements for work relating to the installation of equipment.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Installation and materials for installation shall comply with the following:

1. NFPA 54, "National Fuel Gas Code."
2. NFPA 70, "National Electrical Code."
3. California Code of Regulations (CCR), Title 24 as follows:

a. Part 2, California Building Code.
b. Part 3, California Electrical Code.
c. Part 4, California Mechanical Code.
d. Part 5, California Plumbing Code.
e. Part 9, California Fire Code.

1.4 COORDINATION

A. Coordinate equipment layout and installation with other work, including plumbing and electrical connections, and locations and requirements of utility service connections.

1. Coordinate with wall framers for proper location of wall blocking and backing required as indicated for equipment to be mounted to and/or anchored to walls.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials and hardware for installation of equipment and appliances as recommended by equipment and/or appliance manufacturers, and as required for a complete and operational installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, utility connections, and other conditions affecting installation and performance of residential and/or commercial appliances, fixtures and equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Obtain and comply with equipment manufacturer's written installation instructions.

B. Install equipment with operational and maintenance clearances that comply with equipment manufacturer's written installation instructions and with requirements. Provide anchorage of equipment to building structure, walls, floors and ceilings as indicated or required. Take special care to protect existing finishes.

C. Place units in final locations after finishes have been completed in each area.

D. Connect equipment and appliances to building service utilities in compliance with plumbing, mechanical, and electrical requirements.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections.

1. Perform visual, mechanical, and electrical inspection and testing for each equipment installation according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test for Plumbing Connections: After installation, test for leaks. Repair leaks and retest until no leaks exist.

END OF SECTION

SECTION 111136
ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Level 2 AC electric vehicle supply equipment (EVSE).

B. Related Requirements:

1. Division 03 Section “Cast-in-Place Concrete” for concrete footings for EVSE.
2. Division 26 Electrical Sections as applicable to power supply and connections.

1.3 REFERENCES

A. The EVSE referenced herein shall be designed and manufactured according to comply with the following.

1. California Electrical Code (CEC), latest adopted edition.
2. UL 2202 Electric Vehicle Charging Equipment.
3. UL 2231-1, UL 2231-2 and UL 2594 Standard Testing and Certification.
4. UL 489 - Molded Case Circuit Breakers.

1.4 SUBMITTALS

A. Product Data: For each type of product, include construction details, material descriptions, dimensions of individual components and profiles, rated capacities, operating characteristics, electrical characteristics, and furnishes.

B. Shop Drawings: For each EVSE model.

1. Indicate front and side enclosure elevations with overall dimensions, conduit entrance locations and requirements, nameplate legends, one-line diagrams, equipment schedule and instrument details.
2. Include plans, elevations, and anchorage details.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Include diagrams for power and control wiring.

C. Qualification Data: For Installer.

D. Certificate signed by Contractor certifying that installation complies with manufacturer requirements.

E. Field quality-control reports.

F. Operation and Maintenance Data: For EVSE to include in operation, and maintenance manuals.

1. Include detailed manufacturer’s written instructions on adjusting overcurrent protective devices.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by EVSE manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products in conformance with manufacturer's written instructions.

B. Each EVSE shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.

C. Inspect and report concealed damage to carrier within their required time period.

D. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to internal components, enclosure, and finish.

1.7 FIELD CONDITIONS

A. Verify dimensions by field measurements.

B. Determine suitable path for moving EVSE into place considering project conditions.

1.8 MAINTENANCE AGREEMENT

A. Provide 5-year monitoring, maintenance and support, and five (5) years of prepaid Cloud Subscription Plan.

B. Provide 1-year monitoring, maintenance and support, and one (1) years of prepaid Cloud Subscription Plan.

1.9 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of EVSE that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Lesser of five (5) years from date of purchase or installation.

PART 2 - PRODUCTS

2.1 ACCESSIBILITY REQUIREMENTS

A. Accessibility Requirements: For EVSE indicated to be for accessible charging spaces, comply with the DOJ's "2010 ADA Standards for Accessible Design" and the accessibility requirements of the California Building Code.

2.2 LEVEL 2 AC ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)

A. Basis of Design: Design, Drawings, and Specifications are based on the following:

1. ChargePoint; Model CT4011-GW1-CR (single port charging) and/or Model CT4021-GW-CR (Dual port charging) EVSE with the following accessories/options:

a. Power Management Kit: CT4000-PMGMT.
b. Bollard Mounting Kit: CT4001-CCM.
c. 5-year ChargePoint Commercial Service Plan: CPCLD-Commercial-5.
d. 5-year ChargePoint Assure: CT4000-ASSURE5.
e. Station Activation and Configuration: CPSUPPORT-ACTIVE.
f. ChargePoint Station Installation and Validation: CT4000-INSTALLVALID.

2. Subject to compliance with requirements, provide product indicated or equivalent products by one of the following:

a. ABB.
b. Blink.

B. Product Characteristics:

1. Input Voltage: 208-240VAC (2P+G), 1-phase, 60Hz.
2. Output Voltage 240VAC, 1-phase.
3. Full Load Amps | Maximum Over Current Protection: 32 FLA | 40A MOCP (per circuit).
4. Connectors: SAE J1772 connector with locking holster, one per charge port.
5. Power Share Charge Mode: 2.9kW per port (5.8kW total for dual port chargers).
6. Power Factor: >0.98.

7. LCD Display: 5.7 inch full color, 640x480, 30fps full motion video, active matrix, UV protected.
8. Card Reader: ISO/IEC 14443, ISO 15693, NFC.
9. Metering Accuracy: +/-2% from 2% to full scale (30A).
10. Operating Temperature: -40-deg F to 122-deg F.
11. Dimensions: 9.2 inches W x 19 inches D x 71.3 inches H.
12. Station Enclosure Rating: NEMA 3R with UL 50E gaskets.
13. Cooling System: Air cooling fans.
14. Weight: 105+/- lbs.
15. Compliance: UL and CE Certified.
16. Charging Cable: Manufacturer standard cut resistant 18-ft length with retractor included, one per charge port.
17. Communication | Protocol: Wide Area Network LTE 4G / Loal Area Network 2.4Ghz WiFi OCPP 1.6.
18. Electrical Safety: GFCI CCDI 20mA type A; Surge Protection 6kV at 3,000A; Sensing: over voltage, under voltage, overcurrent, short circuit and missing ground. Output power disabled when output is short circuited. Safety shutoff temperature sensor at charge coupler and power electronics. Integral emergency stop button disables output power.
19. Electric vehicle supply equipment shall bear an Arc-Flash Hazard warning label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including equipment bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical systems to verify actual locations of connections before parking control equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install EVSE at locations indicated on Drawings in accordance with manufacturer's written instructions, the CEC, and local codes.

B. Install EVSE on concrete based as indicated on Drawings. Support electric vehicle supply equipment on concrete bases per project details and manufacturer’s instructions.

C. Remove any temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from EVSE units and components after installation.

3.3 CONNECTIONS

A. Connect EVSE and components to wiring systems and to ground in accordance with manufacturer’s written instructions and as specified in applicable Division 26 Electrical Specification Sections.

B. Tighten electrical connectors and terminals, including screws and bolts, according to manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicated, use those specified in UL 786A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect EVSE installations, including connections.

B. Perform the following tests and inspections:

1. Provide acceptance testing and startup for EVSE as directed by the equipment manufacturer.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. EVSE will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

1. Submit certified reports of Independent Tests and Observations indicating and interpreting test results.
2. Submit calibration record for all testing devices used.

3.5 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturer's specifications.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings.

3.6 CLEANING

A. Upon completion of installation, inspect interior and exterior of EVSE. Remove paint spatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

3.7 MAINTENANCE SERVICE

A. Maintenance Service Description: Beginning at Substantial Completion, maintenance service shall include maintenance by skilled employees of EVSE Installer for period indicated in Part 1 Article “Maintenance Agreement.” Include preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper EVSE operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain EVSE.

END OF SECTION

SECTION 114000
FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fabricated equipment.
2. Cooking equipment.
3. Walk-in refrigeration equipment.
4. Warewashing equipment.
5. Serving equipment.
6. Stainless steel wall paneling/flashing.

B. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment for installation by Contractor.

C. Related Sections:

1. Division 21, 22, and 23 Sections as applicable to Plumbing and Mechanical Work for supply and exhaust fans, vent hoods, exhaust ductwork, service roughing-ins, drain traps, atmospheric vents, valves, pipes, fittings, fire-extinguishing systems, and other materials required to complete foodservice equipment installation.
2. Division 26 Sections as applicable to Electrical Work for connections to fire-alarm systems, wiring, disconnect switches, and other electrical materials required to complete foodservice equipment installation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Manufacturer's model number.
2. Accessories and components that will be included for Project.
3. Clearance requirements for access and maintenance.
4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.

B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Coordination Drawings: For foodservice facilities.

1. Indicate locations of foodservice equipment and connections to utilities.
2. Key equipment using same designations as indicated on Drawings.
3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.
4. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports and seismic bracing; and utility service characteristics.

E. Operation and Maintenance Data: For foodservice equipment to include in emergency, operation, and maintenance manuals. In addition to information for Operation and Maintenance Manuals required in applicable Division 01 Sections, include the following:

1. Product Schedule: For each foodservice equipment item, include the following:

a. Designation indicated on Drawings.
b. Manufacturer's name and model number.
c. List of factory-authorized service agencies including addresses and telephone numbers.

F. Warranty: Samples of special warranty.

1.4 QUALITY ASSURANCE

A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.

B. BISSC Standards: Provide bakery equipment that complies with BISSC/Z50.2.

C. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.

D. Steam Equipment: Provide steam-generating and direct-steam heating equipment that is fabricated and labeled to comply with ASME Boiler and Pressure Vessel Code.

E. Regulatory Requirements: Install equipment to comply with the following:

1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
2. NFPA 54, "National Fuel Gas Code."
3. NFPA 70, "National Electrical Code."

4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."

F. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with foodservice equipment by field measurements before fabrication. Indicate measurements on Coordination Drawings.

1.6 COORDINATION

A. Coordinate foodservice equipment layout and installation with other work, including layout and installation of lighting fixtures, HVAC equipment, and fire-suppression system components.

B. Coordinate locations and requirements of utility service connections.

C. Coordinate sizes, locations, and requirements of the following:

1. Overhead equipment supports.
2. Equipment bases.
3. Floor depressions.
4. Insulated floors.
5. Floor areas with positive slopes to drains.
6. Floor sinks and drains serving foodservice equipment.
7. Roof curbs, equipment supports, and penetrations.
8. Wall backing for installation anchorage of wall mounted equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, type 304.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G90 coating.

2.2 FOOD SERVICE EQUIPMENT

A. Basis of Design: Where manufactured products are indicated by manufacturer and model, provide products indicated or submit substitution request in accordance with Division 01 Sections applicable to substitutions.

B. Food Service Equipment: Provide basis-of-design equipment as indicated on the Drawings and herein specified.

1. Soiled Dish Table, Item 1:

    a. Description: Custom fabricated soiled dish table of size and configuration shown on Drawings fabricated from 0.062 inch (16 gage) stainless steel with (1) 20 x 28 x 14d inch sink, waste chute, drop-off ledge, left-to-right operation, and stainless steel legs.

2. Pre-Rinse Unit, Item 2:

    a. Basis of Design: Manufacturer and model indicated on Drawings.
    b. Description: Wall mount pre-rinse faucet unit with lever handles, 2 inch diameter flanges with 1/2 inch NPT female eccentric flanged inlets, spray valve (T & S Brass #B-0107), stainless steel flex hose (T & S Brass #B-0044-H), and 6 inch wall bracket.

3. Dishwasher, Item 3:

    a. Basis of Design: Manufacturer and model indicated on Drawings.
    b. Description: Straight through design, low temperature chemical sanitizing with priming switches, top mounted controls, automatic start/stop, 40 racks per hour, delimer switch, scrap accumulator, stainless steel construction, 1 open and 1 peg rack, 115v/60 cycle/1 phase, 16 amp.

4. Dishtable, Clean, Item 4:

    a. Basis of Design: Manufacturer and model indicated on Drawings.
    b. Description: Straight clean dishtable fabricated from 0.062 inch (16 gage) stainless steel with stainless steel legs, 10-1/2 inch splash, 3 inch rolled front and side rims, left-to-right operation.

        1) Fabricate to overall length of 54 inches (Contractor to confirm).
        2) Coordinate fabrication with selected dishwasher.

5. Shelf, Item 5:

    a. Basis of Design: Manufacturer and model indicated on Drawings.
    b. Description: Wall mounted 18 gage stainless steel shelf, 12 inches deep by 48 inches wide, 1-1/2 inch sanitary edges with 1-1/2 inch turn-up at back edge.

6. Three Compartment Sink, Item 6:

    a. Basis of Design: Manufacturer and model indicated on Drawings.
    b. Description: Three compartment sink with left and right drain boards, sink compartments 24 inches front to back by 24 inches wide by 8 inches deep, 8 inch high splash, 24 inch wide drain boards, 3 inch high by 1-1/2 inch rolled edges, stainless steel legs. Fabricate unit from 0.062 inch (16 gage) stainless steel

7. Faucet, Item 7:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Sink mixing faucet with 12 inch swing nozzle, 8 inch centers, lever handles.

8. Pot Rack, Item 8:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Wall mounted pot rack, double bar design fabricated from 1/4 inch by 2 inch stainless steel bars, welded construction, 18 plated double hooks, 10 feet long.

9. Hand Sanitizer, Item 9:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Wall mounted hand sanitizing unit with automatic activation.

10. Shelf, Item 10:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Wire shelf, 24 inches deep by 36 inches wide, chrome plated finish.

11. Shelf Posts, Item 11:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Chrome plated round posts allowing shelf adjustment of 1 inch intervals; shelves are held in place by tapered split sleeves fitting into tapered sleeve fittings on shelves, adjustable feet.

12. Walk-in Refrigerator, Item 12:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Modular walk-in cooler of sizes indicated on Drawings.

1) Wall and Ceiling Panels: Insulated metal skinned panels of foamed in place polyurethane insulation with Interlocking tongue and groove edges.

a) Panel Thickness: 4 inches.
b) Insulating value: R factor of not less than 29.
c) Panel surfaces: 26 gage embossed galvanized steel sheet.
d) Corners: Factory preformed 90 degree corners with 12 inch returns.

2) Floors: Insulated floor panels fabricated similar to wall panels and set in recessed concrete slab; floor panels shall be capable of supporting a uniformly distributed load of 700 psf.

a) Exposed Surface: 0.100 inch aluminum tread plate.

3) Doors:

a) Hinges: Self-closing, cam-lift hinges, two per door.
b) Latch: Edge-mounted, positive-type latch with interior safety-release handle that allows opening the door from inside when door is locked.
c) Door Accessories:
d) Pressure relief port.
e) Threshold: Manufacturer's standard.
f) Anti-condensate heater at freezer doors.

4) Vaporproof Lighting Fixtures: Incandescent fixture with 100-W lamp.

a) Control: Neon pilot light and toggle switch located on exterior of door panel.

5) Refrigeration System: Remote system with preassembled condensing unit and evaporator assemblies.

a) Exterior Condensing Units: Include winter control, crankcase heater, and enclosed weatherproof housing.

6) Temperature Monitoring System: Electronic monitoring and remote audible alarm system that warns when temperatures register 10 deg F above or below set temperature.
7) Closure Panels and Trim: Include closure panels and trim.
8) Electrical Service: Equip unit for connection to service indicated on Drawings.

13. Walk-in Freezer, Item 13:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Modular walk-in freezer of sizes indicated on Drawings.

1) Refer to Walk-in-refrigerator, item 12 for additional description.

14. Preparation Table with Sink, Item 14:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: One compartment Prep sink with left, right, or left and right drain boards, sink compartment 20 inches front to back by 16 inches wide by 12 inches deep, 9 inch high splash, 18 inch wide drain board(s), 2 1/2 inch high by 1-1/2 inch rolled edges, stainless steel legs. Fabricate unit from 0.062 inch (16 gage) stainless steel

15. Faucet, Item 15:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Deck mounted mixing faucet, chrome plated brass, 8 inch centers with 1/2 inch IPS eccentric flanged female inlets, lever handles, 10 inch swing nozzle.

16. Shelf, Item 16:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Wall mounted 18 gage stainless steel shelf, 12 inches deep by 10 feet long, 1-1/2 inch sanitary edges with 1-1/2 inch turn-up at back edge.

17. Mobile Heated Cabinet, Item 17:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Stainless steel heated mobile cabinet with insulated bottom and forced air heat system; universal slides hold (24) 12 x 20 inch or (12) 18 x 26 inch pans at 3-1/2 inch spacing, slides adjustable in 1-3/4 inch increments; 5 inch diameter swivel casters; 120v, 60 cycle, single phase power; 1,650 watt, 13.7 amps; NEMA 5-20P, Energy Star rated.

18. Service Counter, Item 18:

a. Description: Custom fabricated 0.062 inch (16 gage) stainless steel service counter, 21'-7" long.

1) Size: 30"
2) Front Edge: Square
3) Sides: Square
4) Coordinate fabrication of unit with Drop-in Hot and Cold Combination Panes, item 19.
5) Feet: Stainless-steel adjustable bullets.

19. Drop-in Hot and Cold Combination Pans, Item 19:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Insulated hot and cold drop in pans.

1) Top/Cover: one-piece 20 gage stainless steel.
2) Interior Liner: 18 gage stainless steel with 1 inch diameter drain.
3) Exterior Body: 24 gage galvanized steel.
4) Insulation: Polyurethane.
5) Cooling: Condensing unit suspended below unit. HFC-404A refrigerant, temperature controlled by thermostat lacated next to condensing unit.
6) Heating: Stainless steel immersion heaters for wet heating.
7) Controls: Remote control panel with 3-way hot/cold/off power switch and thermostat for heated operation.
8) Electrical: Unit to be hard wired at installation.

20. Work Table, Item 20:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: 24 by 96 inch, 0.062 inch (16 gage) stainless steel work table with 18 gage stainless steel undershelf and stainless steel legs; 1-5/8 inch sanitary rolled edges front and back, square edged sides.

21. Convection Oven, Item 21:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Gas/electric convection oven with double glass doors.

1) Construction: Stainless steel.
2) Burners: 4 burners, 180,000 Btu total.
3) Racks: 5 chrome steel wire racks.
4) Lighting: (2) 40 watt interior lights with momentary contact switch.
5) Motor: 2 speed motor, 1,725 and 1,140 RPM, 120 VAC, 1 PH, 9 Amp.
6) Burner “ON” light.
7) Timer: manual, 60 minute.

22. Range, Item 22:

a. Basis of Design: Manufacturer and model indicated on Drawings.
b. Description: Gas cooking surface and ovens, 4 burners, griddle, 2 ovens, 48 inches wide, 20 inch high stainless steel back.

1) Exterior Construction: Stainless steel.
2) Burners: 4 burners, 32,000 Btu each burner, one standing pilot light for each burner.
3) Griddle: One 24 inch wide stainless steel plate griddle, (2) 20,000 Btu burners.
4) Ovens: (2) 20 inch wide ovens, 27,000Btu each oven, porcelain coated oven interior, oven doors lift off for cleaning and servicing, one chrome steel wire rack for each oven, Thermostatic control 150-500 degrees F, matchless push button ignition.
5) Broilers: Top ported burners with 15,000 Btu rating each broiler.

23. Exhaust Hood, Item 23:

a. Exhaust hood shall be as specified in Division 23 Section “Heating, Ventilating, and Air Conditioning” and as indicated on the Mechanical Drawings.

24. Exhaust System, Item 24:

a. Exhaust system shall be as specified in Division 23 Section “Heating, Ventilating, and Air Conditioning” and as indicated on the Mechanical Drawings.

25. Makeup Air System, Item 25:

a. Make-up air system shall be as specified in Division 23 Section “Heating, Ventilating, and Air Conditioning” and as indicated on the Mechanical Drawings.

26. Hood Fire Suppression System, Item 26:

a. Hood fire suppression system shall be as specified in Division 21 Section “Fire Protection” and as indicated on the Mechanical Drawings.

27. Stainless Steel Wall Lining, Item 27:

    a. Basis of Design: Manufacturer and model indicated on Drawings.
    b. Description: Stainless steel wall paneling.

2.3 STAINLESS STEEL WALL PANELING

A. Stainless Steel Wall Paneling: Stainless steel wall paneling system that includes panels, outside corners, inside corners, and trim, including bottom J-mold at top of coved wall base below. Panel system shall include stainless steel panels that have recessed overlap joints that maintain panel flatness and minimizes panel protrusion.

    1. Material: Type 304 stainless steel.
    2. Thickness: 18 gauge.
    3. Surface: Flat.
    4. Finish: No. 3 or No. 4.
    5. Panel Size: Custom size for project condition, 4 ft by 10 ft maximum panel size.

B. Trim: Inside corners, outside corners, edge and end trim as required for project conditions.

    1. Material: Match wall panels.
    2. Thickness: 16 gauge.

2.4 MISCELLANEOUS MATERIALS

A. Installation Accessories, General: NSF certified for end-use application indicated.

B. Elastomeric Joint Sealant: ASTM C 920; silicone, Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.

    1. Public Health and Safety Requirements:

        a. Sealant is certified for compliance with NSF standards for end-use application indicated.
        b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.

    2. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter greater than joint width.

C. Adhesive for Wall Panels: Adhesive as recommended by wall panel manufacturer and NSF compliant.

    1. VOC Content: Adhesive shall have a VOC content of 50 g/L or less.

2.5 FINISHES

A. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

    a. Run grain of directional finishes with long dimension of each piece.
    b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
    c. Stainless-Steel Finish: Directional satin finish, No. 4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install foodservice equipment level and plumb, according to manufacturer's written instructions.

1. Connect equipment to utilities.
2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

B. Complete equipment assembly where field assembly is required.

1. Provide closed butt and contact joints that do not require a filler.
2. Grind field welds on stainless-steel equipment until smooth and polish to match adjacent finish.

C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.

D. Install cabinets and similar equipment on bases in a bed of sealant.

E. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

F. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

3.2 CLEANING AND PROTECTING

A. After completing installation of equipment, repair damaged finishes.

B. Clean and adjust equipment as required to produce ready-for-use condition.

C. Protect equipment from damage during remainder of the construction period.

3.3 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain foodservice equipment.

END OF SECTION

SECTION 114126

WALK-IN COOLERS AND FREEZERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Walk-in coolers and freezers including insulated panels, doors, equipment, and accessories.

B. Related Sections:

1. Division 03 Section “Cast-in-Place Concrete” for concrete depressed floor slabs.
2. Division 21, 22, and 23 Sections as applicable to Plumbing and Mechanical Work for supply and exhaust fans; exhaust ductwork; service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; fire-extinguishing systems; and other materials required to complete food service cooling and freezing equipment installation.
3. Division 26 Sections as applicable to Electrical Work for connections to fire-alarm systems, wiring, disconnect switches, lighting systems and other electrical materials required to complete foodservice equipment installation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Manufacturer's model number.
2. Accessories and components that will be included for Project.
3. Clearance requirements for access and maintenance.
4. Utility service connections for water, drainage, power, and controls; include roughing-in dimensions.

B. Shop Drawings: For walk-in coolers and freezers, include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, wiring diagrams, and attachments to other work. Show attachment details for lateral anchorage to adjacent walls and trim details where cooler and freezer boxes abut adjacent building walls, ceilings, floor.

C. Qualification Data: For installer.

D. Operation and Maintenance Data: For walk-in coolers and freezers to include in operation and maintenance manuals.

E. Warranties: Samples of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 COORDINATION

A. Coordinate walk-in-cooler and freezers box and equipment installation with other work, including layout and installation of lighting fixtures, HVAC equipment, and fire-suppression system components.

B. Coordinate locations and requirements of utility service connections.

C. Coordinate sizes, locations, and requirements of the following:

1. Floor depressions.
2. Insulated floors.
3. Floor areas with positive slopes to drains.
4. Roof curbs, equipment supports, and penetrations.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with cooler and freezer equipment by field measurements before fabrication. Indicate measurements on Coordination Drawings.

1.8 WARRANTY

A. Refrigeration Compressor Warranty: Manufacturer agrees to repair or replace compressors and other operating equipment that fail in materials or workmanship within specified warranty period.

1. Failure includes, but is not limited to, inability to maintain set temperature.
2. Warranty Period: Five (5) years from date of Substantial Completion.

B. Panel Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal-faced insulated panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures, including rupturing, cracking, or puncturing.
    b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.

B. UL Certification: Provide electric equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.

C. Regulatory Requirements: Install equipment to comply with the following:

1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
2. NFPA 70, "National Electrical Code."

D. Flammability: Foam insulation core shall have a flame spread rating of 25 or less and 450 or less smoke rating per ASTM E 84 and UL 723.

2.2 WALK-IN COOLERS AND FREEZERS

A. Manufacturer: Provide walk-in refrigeration systems by one of the following:

1. Master-Bilt, LLC.
2. Bush Refrigeration, Inc.
3. ThermalRite
4. Vollrath Refrigeration
5. Kolplak.
6. U.S. Cooler
7. Equivalent manufacturer subject to request for substitution per Division 01 Section “Substitution Procedures.”

B. Description: Modular walk-in Cooler/Freezer of size and configuration indicated on Drawings.

C. Panels: Modular wall and ceiling panels; factory formed insulated metal skinned panels of foamed in place polyurethane insulation with interlocking tongue and groove edges.

1. Panel Thickness: 4 inch nominal thickness with the following thermal properties.

    a. Coolers: R-value not less than 28.
    b. Freezers: R-value not less than 32.

2. Panel surfaces: 24 gage stainless steel sheet, where concealed, and 22 gage stainless steel where exposed at walls and ceiling.
3. Corners: Factory preformed 90 degree corners with 12 inch returns.
4. Closure Panels and Trim: Manufacturer's standard stainless steel angle trim matching exposed panel finishes and as required for project conditions to close gaps between panels and adjacent construction.

D. Doors: Insulated flush door of construction and finish matching wall panels.

1. Insulating value:

   a. Coolers: R-value not less than 28.
   b. Freezers: R-value not less than 32.

2. Clear Opening: Width as indicated on Drawings, not less than 36 inches wide by 68 inches high.
3. Door perimeter and Frame: Fiberglass reinforced plastic.
4. Hinges: Cam-lift hinges, two per door, minimum.
5. Closer: Manufacturer's standard.
6. Latch: Edge-mounted, Keyed, positive-type latch with interior safety release handle that allows opening the door from inside when door is locked.
7. Door Seals: Magnetic gasket three sides and magnetic double sweep at door bottom.
8. Threshold: Manufacturer's standard, stainless steel, maximum ½ inch high with 2:1 beveled edges.
9. Anti-Condensate Heater: Manufacturer's standard four sided (Head, jambs, threshold) door edge heater cable.
10. Pressure Relief Port: Manufacturer's standard heated air vent.
11. Kick Plate: Manufacturer's standard stainless steel kick plates at push sides of doors.

E. Floor Panels: Insulated cooler and freezer floor panels fabricated similar to wall panels and set in recessed concrete slab. Floor panels shall be formed with a 1/2 inch high cove base at the floor to wall transition. Floor panels shall be capable of supporting a uniformly distributed load of 700 psf and have a non-slip texture.

1. Exposed Surface: Aluminum Diamond Tread

F. Vaporproof Lighting Fixtures: Manufacturer's standard LED fixture.

1. Control: LED pilot light and toggle switch located on exterior of door panel.

   a. Provide 3 way switching.

G. Refrigeration System: Remote system with preassembled condensing unit and evaporator assemblies sized by manufacturer for project conditions.

1. Exterior Condensing Units: Include winter control, crankcase heater, and enclosed weatherproof housing.
2. Refrigerant: R449A.
3. Power Requirements: 208 volt, 1 phase.

H. Temperature Monitoring: Manufacturer’s standard digital thermometer with alarm bell when temperature increases above or drops below preset temperature limits.

2.3 MISCELLANEOUS MATERIALS

A. Elastomeric Joint Sealant: ASTM C 920; silicone, Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.

1. Public Health and Safety Requirements:

a. Sealant is certified for compliance with NSF standards for end-use application indicated.
b. Washed and cured sealant complies with the FDA’s regulations for use in areas that come in contact with food.

2. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter greater than joint width.

B. Provide 36” high stainless steel 20 gage diamond plate kick plate at doors and exposed wall panels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify rooftop equipment platform is water-tight and ready for installation of outdoor compressor.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install walk-in cooler and freezer components to comply with manufacturer's written installation instructions. Provide 2 inch clear air space away from adjacent walls.

B. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

C. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints with cam or other locking mechanisms.

3.3 ADJSUTING AND CLEANING

A. On completion of installation, lubricate, test, and adjust equipment so that it operates according to manufacturer's written operating instructions.

B. Clean installed exposed and semi-exposed surfaces. Touch up shop-applied finishes or replace components as required to restore damaged or soiled areas.

C. Protect installed components from damage during remainder of the construction period.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment.

END OF SECTION

SECTION 115213
PROJECTION SCREENS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated projection screens.
2. Electrically operated projection screens and controls.

B. Related Sections:

1. Division 26 Sections for electrical service and connections including device boxes for switches and control wiring.

1.3 DEFINITIONS

A. Gain of Front-Projection Screens: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show layouts and types of projection screens. Include the following:

1. For manually operated projection screens:

a. Drop lengths.
b. Anchorage details.
c. Accessories.

2. For electrically operated projection screens and controls:

a. Location of screen centerline relative to ends of screen case.
b. Location of wiring connections for electrically operated units.
c. Location of seams in viewing surfaces.

d. Drop lengths.
e. Anchorage details, including connection to supporting structure for suspended units.
f. Details of juncture of exposed surfaces with adjacent finishes.
g. Accessories.
h. Wiring diagrams.

C. Maintenance Data: For projection screens to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations for Projection Screens: Obtain projection screens from one source and from a single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install projection screens until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and wall and ceiling framing.

B. Coordinate installation of motor operated projection screens with electrical work

PART 2 - PRODUCTS

2.1 SCHEDULED PROJECTION SCREENS

A. General: Provide projection screens to comply with requirements in this Section and as scheduled in Part 3 "Projection Screen Schedule."

B. Basis-of-Design Products: Products indicated in this Section are based on products manufactured by:

1. The Da-Lite Screen Company.

a. Subject to compliance with requirements, provide products indicated or comparable products by one of the following:

1) Bretford, Inc.
2) Draper Inc.

2.2 PROJECTION SCREENS, GENERAL

A. Rollers: Manufacturer’s standard rollers of sizes and material as recommended by manufacturer.

B. Bottom Bar: Manufacturer’s standard weighted bottom bar.

C. Screen Mounting: Top edge of screen to be securely anchored to a rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.

D. Tab Tensioning: Where indicated, provide units with a durable low-stretch cord on each side of screen connected to edge of screen by tabs to maintain even lateral tension to hold viewing surface flat.

E. Controlled Screen Return: Where indicated, provide units with manufacturer’s standard controlled screen return to limit the speed of return to ensure a smooth return.

2.3 MANUALLY OPERATED PROJECTION SCREENS

A. General: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.

B. Bracket-Mounted or Ceiling-Suspended, Metal-Encased, Manually Operated Screens: Units designed and fabricated for suspending from wall brackets or ceiling, fabricated from formed-steel sheet not less than 0.027 inch (22 gage) thick; with baked-enamel finish and matching end caps. Provide mounting brackets unless otherwise indicated.

1. Basis of Design: Da-Lite Screen Company; Model B.

C. Recessed Ceiling Mounted, Metal-Encased, Manually Operated Screens: Units designed and fabricated for recessed mounting above ceiling; top, front, and back of case to be fabricated from aluminum extrusions, end caps formed from steel sheet; case to have a baked-enamel finish; bottom of case to have a built-in self-trimming flange around the perimeter and have a removable access door.

1. Basis of Design: Da-Lite Screen Company; Advantage Manual with CSR.

2.4 ELECTRICALLY OPERATED PROJECTION SCREENS

A. General: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation.

Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Controls: Remote, key-operated, three-position control switch installed in recessed device box with flush cover plate matching other electrical device cover plates in room where switch is installed.

    a. Provide power supply for low-voltage systems if required.
    b. Provide video interface control for connecting to projector. Projector provides signal to raise or lower screen.

B. Suspended, Electrically Operated Screens without Ceiling Closure: End-mounted motor units designed and fabricated for suspended mounting, with bottom of case open under screen compartment. Wood case with reinforced top and metal lined motor compartment; prime painted black. Instant-reversing, gear-drive motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Locate motor in its own compartment.

    1. Basis of Design: Da-Lite Screen Company; Senior Electrol.

C. Suspended, Electrically Operated Screens with Automatic Ceiling Closure: Motor-in-roller unit designed and fabricated for suspended mounting; with bottom of case composed of two panels, fully enclosing screen, motor, and wiring; one panel hinged and designed to open and close automatically when screen is lowered and fully raised, the other removable or openable for access to interior of case. Extruded aluminum case with steel end plates and built-in exposed self-trimming flange; doors of aluminum extrusions; baked enamel finish. Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.

    1. Basis of Design: Da-Lite Screen Company; Tensioned Director Electrol

2.5 FRONT-PROJECTION SCREEN MATERIAL

A. Basis of Design Product: Da-Lite Screen Company; Matte White.

    1. Screen Material: Vinyl-coated, glass-fiber fabric, matte-white viewing surface with peak gain not less than 0.9, and gain not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.

        a. Mildew-Resistance Rating: 0 or 1 when tested according to ASTM G 21.
        b. Flame Resistance: Passes NFPA 701.
        c. Flame-Spread Index: Not greater than 75 when tested according to ASTM E 84.

B. Seamless Construction: Provide screens, in sizes indicated, without seams.

1. Where length of screen indicated exceeds maximum length produced without seams in material specified, provide screen with horizontal seam placed at top of screen at juncture between extra drop length and viewing surface.

C. Edge Treatment: Black masking borders.

D. Extra Drop Length: Where required or indicated, provide extra drop length.

1. Color: Black.

PART 3 - EXECUTION

3.1 PROJECTION SCREEN INSTALLATION

A. Install projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.

1. Install low-voltage controls according to NFPA 70 and complying with manufacturer's written instructions.

a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.
3. Test manually operated units to verify that screen-operating components are in optimum functioning condition.

3.2 PROJECTION SCREEN SCHEDULE

A. Projection Screen PS-1

1. Basis of Design: Da-Lite Screen Company; Model B.
2. Location: Classrooms.
3. Type: Spring roller.
4. Operation: Manual.
5. Mounting: Wall bracket or ceiling clips, as indicated on Drawings.
6. Format: Video
7. Screen Size: 50 by 67 inches, height by width.
8. Screen Surface: Matte white.

9. Options: Extra drop, provide approximately 3 feet of extra drop so that the bottom of the screen can extend to 42 inches above the floor.

B. Projection Screen PS-2

1. Basis of Design: Da-Lite Screen Company; Advantage Manual with Controlled Screen Return.
2. Location: Building 1, Conference Room.
3. Type: Spring roller with controlled return.
4. Operation: Manual.
5. Mounting: Recessed in ceiling.
6. Format: Video
7. Screen Size: 50 by 67 inches, height by width.
8. Screen Surface: Matte white.
9. Options:

    a. Controlled Screen Return (CSR)
    b. Extra drop, provide approximately 3 feet of extra drop so that the bottom of the screen can extend to 42 inches above the floor.

C. Projection Screen PS-3

1. Basis of Design: Da-Lite Screen Company; Tensioned Director Electrol.
2. Location: Building 1, Library Reading Room and Computer Lab.
3. Type: Automatic with automatic ceiling closure door.
4. Operation: Motor operated with remote control station.
5. Mounting: Recessed in ceiling.
6. Format: Video
7. Screen Size: 50 by 67 inches, height by width.
8. Screen Surface: Matte white.
9. Options:

    a. Screen Tensioning.
    b. Extra drop, provide approximately 3 feet of extra drop so that the bottom of the screen can extend to 42 inches above the floor.

D. Projection Screen PS-4

1. Basis of Design: Da-Lite Screen Company; Senior Electrol.
2. Location: Building 8, Multi-Use.
3. Type: Automatic with no ceiling closure.
4. Operation: Motor operated with remote control station.
5. Mounting: Recessed in ceiling.
6. Format: Video
7. Screen Size: 123 by 164 inches, height by width.
8. Screen Surface: Matte white.

END OF SECTION

SECTION 115216

PROJECTOR MOUNTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Projector mounts and accessories.

B. Related Sections:

1. Division 26 Sections for electrical service and connections including device boxes for switches and control wiring.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show layouts and types of projection screens. Include the following:

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain projector mounts from a single source and from a single manufacturer.

1.5 COORDINATION

A. Coordinate layout and installation of projector mounts with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and wall and ceiling framing.

PART 2 - PRODUCTS

2.1 PROJECTOR MOUNTS AND ACCESSORIES

A. Projector Mounts and Accessories, General: Projector mounting assembly and accessories for ceiling mounted projectors; includes support plate, projector mount, and brace wires.

1. Basis of Design Product: Drawings and Specifications are based on products manufactured by:

a. Premier Mounts.

B. Projector Mounts: Premier Mounts; PBC-UMS Universal Projector Mount.

1. Description: Universal ceiling projector mount with four double jointed support arms with adjustable leveling feet.
2. Weight Capacity: 40 lbs maximum.
3. Height: 8-1/2 inches nominal.
4. Support Connection: 1-1/2 inch National Pipe Thread (NPT).
5. Pitch: +/- 20 degrees.
6. Roll: +/- 20 degrees.
7. Yaw: 360 degrees.
8. Color: Black.

C. Ceiling Plates: Premier Mounts; PP-FCTA ceiling adapter plate.

1. Description: Adjustable projector mount support plate assembly designed to be installed over a suspended ceiling tile and connect to the suspended ceiling grid system, and with brace wires to the structure above. Support plate to include 2 knock outs for electrical boxes.
2. Weight Capacity: 50 lbs maximum.
3. Projector Connection: 1-1/2 inch NPT (female).
4. Color: White.

D. Wire Bracing: Manufacturer’s standard wire cable and turnbuckles capable of supporting not less than 75 lbs per brace wire.

PART 3 - EXECUTION

3.1 PROJECTOR MOUNT INSTALLATION

A. Install project mount and accessories in accordance with manufacturer’s written installation instructions and as indicated on the Drawings.

1. Projector mount support plate assemblies shall be laterally braced with a set of four diagonal wires with turnbuckles connected to the support plate and the structure above.

END OF SECTION

SECTION 123661

QUARTZ COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops including backsplashes, end splashes, and apron fronts.

B. Related Requirements:

1. Division 05 Section(s) “Cold Formed Metal Framing” and “Metal Framing” for stainless steel and other metal support framing for quartz counter tops.
2. Division 06 Section(s) as applicable to casework for casework supporting countertops.
3. Division 11 Section “Food Service Equipment” for kitchen equipment requirements including cut-outs and attachments.
4. Division 22 Section(s) as applicable to plumbing fixtures for sinks and plumbing fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. One full-size sample of countertop with front edge, backsplash, and end splash; 8 by 10 inches, of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Woodwork Quality Standard Compliance Certificates: WI-certified compliance certificates.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, who are familiar with Woodwork Institute fabrication requirements, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Installer shall be fabricator of countertops, or fabricator shall be responsible for the Work of the installer. Installers shall be skilled workers who are experienced installing products similar to those required for this Project, who are familiar with Woodwork Institute installation requirements, and have a record of successful in-service performance.

C. Woodwork Institute (WI) Quality Assurance Program: Quartz countertops shall be subject to the following WI quality assurance program:

1. Certified Compliance Program (CCP):

    a. A WI Certified Compliance Label shall be affixed to the first page of the original shop drawing set.
    b. A WI Certified Compliance Certificate shall be issued for plastic laminate cabinets, countertops and installation.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements, Accessibility: Countertops shall comply with accessibility requirements of the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) 2010 ADA Standards for Accessible Design and with the 2022 California Building Code, Chapter 11B, “Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.” Accessible countertops shall comply with the following:

1. Countertop Heights for Sinks and Lavatories: Where self-rimming sinks or lavatories are installed in countertops and the fixtures are indicated to be accessible, countertop heights shall be verified and coordinated so that the top rim of sinks and lavatories shall not be more than 34 inches above the finished floor; for self-rimming sinks, countertop heights shall be set at +33-1/2 inches above the finish floor level.
2. Knee and Toe Space at Sink Countertops (Ref. CBC 11B-306):

    a. Width: 30 inches minimum clear width.
    b. Vertical Clearance: 27 inches minimum at the front edge of countertops and/or aprons.
    c. Depth of Knee and Toe Clearance: Measured from the front edge of countertops.

        1) Depth at Floor Level: 19 inches minimum / 25 inches maximum; and not less than the reach depth over the countertop.
        2) Depth at +9 Inches: Depth at floor level less 6 inches maximum (13 inches minimum depth at +9 inches for a clear space depth of 19 inches at floor level; depth increases as depth at floor level increases).
        3) Depth at +27 Inches: Depth at floor level less 9 inches maximum (10 inches minimum depth at +27 inches for a clear space depth of 19 inches at floor level; depth increases as depth at floor level increases).

3. Knee and Toe Space at Lavatory Countertops (Ref. CBC 11B-306):

    a. Width: 30 inches minimum clear width.
    b. Vertical Clearance: 29 inches minimum at the front edge of countertops and/or aprons.
    c. Depth of Knee and Toe Clearance: Measured from the front edge of countertops.

        1) Depth at Floor Level: 17 inches minimum / 19 inches maximum; and not less than the reach depth over the countertop; actual depth may exceed 19 inches although it may not be considered as additional accessible toe space.
        2) Depth at +9 Inches: Depth at floor level less 6 inches maximum (11 inches minimum depth at +9 inches for a clear space depth of 17

inches at floor level; depth increases as depth at floor level increases).

3) Depth at +27 Inches: Depth at floor level less 9 inches maximum (8 inches minimum depth at +27 inches for a clear space depth of 17 inches at floor level; depth increases as depth at floor level increases).

4. Side Reach Depth Over Countertops (Ref. CBC 11B-308.3.2): Where countertops are to be accessible, countertops shall be fabricated such that the side reach depth does not exceed 24 inches measured from the front edge of the countertop to the finished surface of the wall at the back of the countertop. Countertop heights shall not exceed 34 inches from the finished floor surface.

B. Quality Standard: Unless otherwise indicated, comply with Woodwork Institute's (WI) "North American Architectural Woodwork Standards" (NAAWS), latest edition, for grades of countertops indicated for construction, finishes, installation, and other requirements.

2.2 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

1. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Plywood Sub-Tops: Exterior softwood plywood (min. 8-ply 5/8 inch thick) complying with DOC PS 1, Grade C-C Plugged, touch sanded. Provide melamine facing where surfaces are exposed in food preparation areas.

2.3 COUNTERTOP FABRICATION

A. Quality Standard: Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "North American Architectural Woodwork Standards." (NAAWS), latest edition, Section 11 "Countertops" for grade indicated.

1. Grade: Premium.

B. Countertops: 3/4-inch thick, quartz agglomerate with front edge built up with same material. Aprons and miscellaneous elements of 5/8-inch thick quartz are permitted where indicated on drawings (match color/pattern).

1. Configuration:

a. Front: Straight, 2 inch laminated built-up edge, slightly eased at top and bottom.

b. Backsplash: Straight, slightly eased at exposed corner edges.

c. End Splash: Matching backsplash.

2. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

C. Back and End Splashes: Quartz agglomerate of same thickness as countertop unless otherwise indicated.

1. Fabricate tops with shop-applied backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
2. Fabricate with loose end splases for field assembly.

D. Joints: Fabricate countertops in sections for joining in field; joint locations shall be identified on shop drawings and approved by Architect.

1. Joint Locations: Not within 18 inches of a cutout and not where a countertop section less than 36 inches long would result, unless unavoidable.
2. Joint Type: Bonded, 1/32 inch or less in width.
3. Splined Joints: Provide splined joints where necessary to insure alignment of joints. Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

E. Cutouts:

1. Undercounter Fixtures: Make cutouts for drop-in equipment and undercounter fixtures in shop to the greatest extent possible using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

    a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Holes for Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.4 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Division 07 Section "Joint Sealants."

C. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Multipurpose Construction Adhesives: 70 g/L.
2. Architectural Sealants: 250 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten subtops to casework by screwing through subtops into corner blocks of base cabinets. Shim as needed to align subtops in a level plane.

1. Where subtops are supported by cantilevered brackets, screw through brackets into subtops, shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. At joints where splines are to be used, install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Division 07 Section "Joint Sealants."

END OF SECTION

SECTION 142400

HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Holeless hydraulic passenger elevators including all work, materials, coordination, inspections, Inspection and Acceptance Certificates, and Operating Permits as required by authorities having jurisdiction for normal, unrestricted elevator use.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for setting inserts, and anchoring devices in concrete.
2. Division 05 Sections “Structural Steel Framing” and "Metal Fabrications" for the following:

    a. Attachment plates and angle brackets for supporting guide-rail brackets.
    b. Hoist beams.
    c. Structural-steel shapes for subsills.
    d. Pit ladders.

3. Division 09 Sections as applicable to flooring for finish flooring in elevator cars.
4. Division 10 Section “Signage” for requirements for panel signs associated with elevators.
5. Division 26 through 28 Sections as applicable for electrical service for elevators including power, communications, and alarms.

1.3 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 “Safety Code for Elevators and Escalators” apply to work of this Section.

B. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.4 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings: Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include large-scale layout of car control. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Governing Agency Deferred Approval: Projects under the jurisdiction of the Division of the State Architect (DSA) require elevator structural design to be reviewed and approved by the Division of the State Architect through a Deferred Approval.

1. Elevator Deferred Approval submittal shall include necessary shop drawings, details, and structural calculations prepared, stamped, and signed by a structural engineer licensed in the State of California. The Elevator manufacturer shall be responsible for the design and engineering calculations and drawings, and shall be responsible for responding to and resolving any comments from the DSA.
2. The Deferred Approval submittal shall be submitted to the Architect through the General Contractor. The Architect will transmit the Deferred Approval submittal to the Division of the State Architect.

D. Samples for Initial Selection: For finishes involving color selection.

E. Qualification Data: For Installer.

F. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

G. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, machine room access, layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

H. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44.

I. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

J. Warranty: Special warranty specified in this Section.

K. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer for installation of units required for this Project.

B. Manufacturer Qualifications: Manufacturer shall have a service office and full time service personnel within a 200 mile radius of the project site.

C. Preinstallation Conference: Conduct conference at project site.

1. Meet with Owner, Architect, elevator manufacturer's representative, and installers whose work interfaces with or affects elevator installation.
2. Review coordination of elevator work with other trades.
3. Review required clearances for elevator equipment and components.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review routing of cable and conduit between elevator equipment room and elevator shaft.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.7 COORDINATION

A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.

B. Coordinate elevator work with work of other trades for proper time and sequence to avoid construction delays.

C. Coordinate locations and dimensions of other work specified in other Sections that relates to hydraulic elevators, including elevator shaft, pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

D. Coordinate cants for projections in elevator shafts and the covering of any recesses in elevator shafts.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND REGULATORY REQUIREMENTS

A. Regulatory Requirements: Comply with the following:

1. ASME A17.1-2019/CSA B44-19, “Safety Code for Elevators and Escalators.”
2. NFPA:

    a. 70-20 National Electrical Code.
    b. 72-22 National Fire Alarm Code, as amended.
    c. 80-19 Standard for Fire Doors and Other Opening Protectives.

3. California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

4. California Code of Regulations, Title 24:

    a. Part 2, Volume 1, California Building Code, 2022 Edition (Fire/life safety and accessibility).
    b. Part 2, Volume 2, California Building Code, 2022 Edition (Structural safety).
    c. Part 3, California Electrical Code, 2022 Edition.
    d. Part 7, California Elevator Safety Construction Code, 2022 Edition.

5. Fire-rated Entrance Assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with NFPA 80 and UL 10B.

B. Energy Requirements: Comply with California Code of Regulations, Title 24, Part 6, California Energy Code, Section 120.6(f) Mandatory Requirements for Elevators.

1. The light power density for the luminaires inside the elevator cab shall be no greater than 0.6 watts per square foot; interior signal lighting and interior display lighting are not included in the calculation of lighting power density.
2. Elevator cab ventilation fans for cabs without space conditioning shall not exceed 0.33 watts per cfm as measured at maximum speed.
3. When the elevator cab is stopped and unoccupied with doors closed for over 15 minutes, the cab interior lighting and ventilation fans shall be switched off until the elevator cab operation resumes.
4. Lighting and ventilation shall remain operational in the event that th elevator cabin gets stuck when passengers are in the cabin.
5. Elevator Lighting and Ventilation Control Acceptance: Before an occupancy permit is granted for elevators subject to the California Energy Code Section 120.6(f), the following equipment and systems shall be certified as meeting the Acceptance Requirement for Code Compliance, as specified by the Referenced Nonresidential Appendix NA7. A certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.14; exception for elevators located in healthcare facilities.

C. Accessibility Requirements: Comply with the following:

1. Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
2. ICC A117.1.
3. 2010 ADA Standards for Accessible Design.
4. 2022 California Building Code, Section 11B-407; requirements include but are not limited to the following:

    a. 11B-407.1 General: Elevators shall comply with CBC Section 11B-407 and with ASME A17.1. Elevators shall be passenger elevators as classified by ASME A17.1. Elevator operation shall be automatic.
    b. 11B-407.2 Elevator Landing Requirements:

        1) 11B-407.2.1. Car Controls:

            a) 11B-407.2.1.2 Height: The centerline of hall call buttons shall be 15 inches minimum, 48 inches maximum above the floor (Design for 42 inches above the floor) per CBC 11B-308.
            b) 11B-407.2.1.2 Size and Shape: Control buttons shall have square shoulders, be 3/4 inch minimum in the smallest dimension and shall be raised 1/8 inch plus or minus 1/32 inch above the surrounding surface. Buttons shall be activated by a detectable mechanical motion.
            c) 11B-407.2.1.3 Clear Floor or Ground Space: A clear floor or ground space of 30 x 48 inches minimum for forward or side reach shall be provided at call controls.

d) 11B-407.2.1.4 Location: The call button that designates the up direction shall be located above the call button that designates the down direction.
e) 11B-407.2.1.5 Signals: Call buttons shall have visible signals that will activate when each call is registered and will extinguish when each call is answered. Call buttons shall be internally illuminated with a white light over the entire surface of the button.
f) 11B-407.2.1.6 Keypads: Where keypads are provided, keypads shall be in a standard telephone keypad arrangement and shall comply with CBC 11B-407.4.7.2.

2) 11B-407.2.2 Hall Signals:

a) 11B-407.2.2.1 Visible and Audible Signals: A visible and audible signal shall be provided at each hoistway entrance to indicate which car is answering a call and the car's direction of travel. Where in-car signals are provided, they shall be visible from the floor area adjacent to the hall call buttons.
b) 11B-407.2.2.2 Hall Signals, Visible Signals: Visible signal fixtures shall be centered 72 inches minimum above the floor. The visible signal elements shall be a minimum of 2-1/2 inches high by 2-1/2 inches wide and be visible from the floor area adjacent to the hall call button.
c) 11B-407.2.2.3 Audible Signals: The audible signals shall sound once for the up direction and twice for the down direction, or shall have verbal annunciation that announces the direction of elevator car travel. Audible signals shall have a frequency of 1500 Hz maximum. Verbal annunciators shall have a frequency lf 300 Hz minimum and 3000 Hz maximum. The audible signal and verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB, measured at the hall call button.

3) 11B-407.2.3.1 Hoistway Signs, Floor Designation: Floor designations shall be provided on both jambs of each hoistway entrance. Floor designations shall be provided in both raised characters and Braille. Raised characters shall be 2 inches high. A raised star, placed to the left of the floor designation, shall be provided on both jambs at the main entry level; the outside diameter of the star shall be 2 inches and all points shall be of equal length. Raised characters, including the star, shall be white on a black background. Braille complying with CBC 11B-703.3 shall be placed below the corresponding raised characters and the star. The Braille translation for the star shall be "MAIN". Applied plates are acceptable if they are permanently fixed to the jamb.

c. 11B-407.3 Elevator Door Requirements:

1) 11B-407.3.1 Door Type: Doors shall be horizontal sliding.
2) 11B-407.3.2 Door Operation: Elevator hoistway and car doors shall open and close automatically.
3) 11B-407.3.3 Door Reopening Device: Doors shall be provided with a protective reopening device that shall stop and reopen a car door and hoistway door automatically if the door becomes obstructed by an object or person. Device shall be activated by sensing an obstruction passing through the opening at nominal heights of 5 and 29 inches (nominal) above the floor. Device shall not require physical contact to be activated, although contact is permitted to occur before the door reverses. Door reopening devices shall remain effective 20 seconds minimum.
4) 11B-407.3.5 Door Delay: Doors shall remain fully open in response to a car call for 5 seconds minimum.
5) 11B-407.3.6 Door Width: 36 inches minimum clear when car inside clear dimensions allow for a wheelchair turning space with the door in a closed position; 42 inches minimum where the door is centered and the minimum car inside dimensions are 80 inches wide, 51 inches deep and 54 inches inside face of door to back wall.

d. 11B-407.4 Car Requirements:

1) 11B-407.4.1 Car Inside Dimensions: Car minimum inside dimensions shall comply with CBC Table 11B-407.4.1; elevators designated as emergency medical service elevators shall be of a minimum size to accommodate a medical gurney and two emergency personnel as required by CBC Section 3002.4a (Dimensions exceed those required for accessibility).
2) 11B-407.4.2 Floor Surfaces: Floor surfaces in elevator cars shall comply with CBC 11B-302 (Floor surfaces) and 11B-303 (Changes in level).
3) 11B-407.4.3 Platform to Hoistway Clearance: The clearance between the car platform sill and the edge of any hoistway landing shall be 1-1/4 inch maximum.
4) 11B-407.4.4 Leveling: Each car shall be equipped with a self-leveling feature that will automatically bring and maintain the car at floor landings within a tolerance of 1/2 inch under rated loading to zero loading conditions.
5) 11B-407.4.5 Illumination: The level of illumination at the car controls, platform, car threshold, and car landing sill shall be 5 foot candles minimum.
6) 11B-407.4.6 Elevator Car Controls:

a) 11B-407.4.6.1 Location: Car controls shall be located within one of the reach ranges specified in CBC 11B-308; the reach range to operate control buttons shall be between 15 inches minimum and 48 inches maximum above the floor (Design for 42 inches above the floor).

b) 11B-407.4.6.2 Buttons: Control buttons shall have square shoulders, be 3/4 inch minimum in the smallest dimension and be raised 1/8 inch plus or minus 1/32 inch above the surrounding surface. Buttons shall be arranged with numbers in ascending order. When two or more columns of buttons are provided, they shall read from left to right. Car control buttons shall be illuminated. Buttons shall be activated by a detectable mechanical motion.

c) 11B-407.4.6.3 Keypads: When provided, car control keypads shall be in a standard telephone keypad arrangement and shall comply with 11B-407.4.7.2.

d) 11B-407.4.6.4 Emergency Controls: Emergency control buttons shall have their centerlines 35 inches minimum above the floor. Emergency controls, including the emergency alarm, shall be grouped at the bottom of the control panel.

7) 11B-407.4.7 Designations and Indicators of Car Controls:

a) 11B-407.4.7.1 Car controls buttons shall be identified by raised characters or symbols, white on a black background, complying with CBC 11B-703.2 and Braille complying with CBC 11B-703.3. Raised characters or symbols and Braille designations shall be placed immediately to the left of the control button to which the designations apply. The control button for the emergency stop, alarm, door open, door close, main entry floor, and phone, shall be identified with raised symbols and Braille as shown in CBC Table 11B-407.4.7.1.3. Buttons with floor designations shall be provided with visible indicators to show that a call has been registered. The visible indication shall extinguish when the car arrives at the designated floor. A minimum clear space of 3/8 inch or other suitable means of separation shall be provided between rows of control buttons.

b) 11B-407.4.7.2 Keypads: Keypads shall be identified by characters complying with CBC 11B-703.5 (Visual Characters) and shall be centered on the corresponding keypad button. The number five key shall have a single raised dot. The dot shall be 0.118 inch to 0.120 inch base diameter and in other aspects comply with CBC Table 11B-703.3.1.

8) 11B-407.4.8 Car Position Indicators:

a) 11B-407.4.8.1 Visible Indicators: Characters shall be 1/2 inch high minimum and be located above the car control panel or above the door. As the car passes a floor and when a car stops at a floor served by the elevator, the corresponding character shall illuminate.

b) 11B-407.4.8.2 Audible Indicators: Elevators that have a rated speed of 200 feet per minute or less are permitted to have a non-verbal audible signal with a frequency of 1500 Hz maximum which sounds as the car passes or is about to stop at a floor served by the elevator.

9) 11B-407.4.9 Emergency Communication: Emergency two-way communication shall comply with CBC 1B-308 (Reach Ranges). Raised symbols or characters, white on a black background, and Braille, shall be provided adjacent to the device and shall comply with CBC 11B-703.2 (Raised Characters) and 11B-703.3 (Braille). Emergency two-way communication systems between the elevator and a point outside the hoistway shall comply with ASME 17.1.

10) 11B-407.4.10 Support Rail/Handrail: Support rails shall be provided on at least one wall of the car. Clearance between support rails and adjacent surfaces shall be 1-1/2 inches minimum. Top of support rails shall be 31 inches minimum to 33 inches maximum above the floor of the car. The ends of the support rail shall be 6 inches maximum from adjacent walls. Support rails shall be smooth and any surface adjacent to them shall be free of sharp or abrasive elements. Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 lbs is applied at any point on the support rail, fastener mounting device, or supporting structure.

D. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the 2022 California Building Code, and shall comply with elevator safety requirements for seismic risk Zone 2 or greater in ASME A17.1/CSA B44.

1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Affected peak velocity acceleration (Av) for Project's location is greater than or equal to 0.20 (seismic risk Zones 3 and 4).
3. Provide earthquake equipment required by ASME A17.1/CSA B44.
4. Provide seismic switch as required by ASCE/SEI 7.
5. Design earthquake spectral response acceleration short period (Sds) for Project is indicated on Structural Drawings.
6. Project's Seismic Design Category is indicated on Structural Drawings.
7. Elevator Component Importance Factor: 1.0.

2.2 HYDRAULIC ELEVATORS

A. Elevator Systems, General: Manufacturer's standard holeless, hydraulic, dual telescoping cylinder elevators using manufacturer’s standard components as required for a complete system.

B. Source Limitations: Obtain elevators from a single manufacturer.

1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2. Schumacher Elevator Company; Holeless hydraulic telescoping elevator Model 40HHLTS1E14.

    a. Subject to compliance with requirements, provide elevators indicated or submit a substitution request per Division 01 Section “Substitution Procedures.”

C. Elevator No. 1:

1. Type: Holeless, beside-the-car, telescoping, dual cylinder, multi-stage hydraulic jacks.
2. Rated Load: 4,000 lbs.
3. Rated Speed: 125 fpm minimum.
4. Travel Distance: 17 feet 0 inches.
5. Overhead Clearance: 12 feet 6 inches.
6. Pit Depth: 4 feet 0 inches
7. Number of Landings: 2.
8. Number of Openings: 2.
9. Inside Car Dimensions: 5 feet 8 inches wide by 7 feet 5 inches deep minimum.

    a. Elevator car shall be of a size to accommodate an ambulance stretcher or gurney measuring 24 inches by 84 inches with not less than 5 inch radius corners in the horizontal position and two emergency personnel each requiring a 21 inch diameter space.

10. Car Height: 8 feet 0 inches.
11. Hoistway Clear Dimensions: 7 feet 10 inches wide by 9 feet 2 inches deep.
12. Door Width (Hoistway and car doors): 4 feet 0 inches wide by 8 feet 0 inches high (Two speed).
13. Door and Frame Material and Finish (Hoistway and Car): Stainless steel, No. 4 Finish.
14. Power Supply: 480 V, 3 phase, 60 Hz.
15. Machine Room Location: Adjacent on first (ground) floor.
16. Auxiliary Operation: Emergency battery lowering unit.
17. Star of Life Identification: Elevator shall be identified by the international symbol for emergency medical services (Star of Life).

2.3 OPERATING/CONTROLLING SYSTEMS

A. Controller: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated, system shall comply with ANSI/ASME A17.1/CSA B44.1. The system shall provide comprehensive means to access the computer memory for elevator diagnostic purposes without the need for external devices and shall have permanent indicators to indicate important elevator status as an integral part of the controller. Systems that require hook-up external devices for troubleshooting or adjustment shall be provided and become the property of the Owner.

B. Automatic Self-Leveling Feature: Provide each elevator car with a self-leveling feature to automatically bring the car to the landings and correct for overtravel or under travel.

Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

D. Heat Detector Shutdown: Upon activation of the heat detector used for elevator power shutdown, there should be a delay in the activation of the power shunt trip. This delay should be the time that it takes the elevator cab to travel from the top of the hoistway to the lowest recall level.

2.4 HOISTWAY EQUIPMENT

A. Guide Rails: Manufacturer's standard steel 'T' section rails, size as required by ANSI/ASME A17.1 for elevator and travel capacity; machined on surfaces on which guide shoes operate; guide rail lengths shall have tongue and groove end joints and shall be joined by splice plates. Rails shall be designed to fasten to the building structure with steel brackets.

B. Guide Shoes: Manufacturer's standard slide guide shoes mounted on top and bottom of the car.

C. Buffers: Provide manufacturer's standard buffers in the elevator pit securely anchored to the pit floor, mounted on a steel template that is fastened to the pit floor, or to continuous channels fastened to the elevator guide rails. Provide extensions if required by project conditions.

D. Normal and Final Stopping Devices: Provide in accordance with ANSI/ASME A17.1.

E. Emergency Stopping Devices: Provide emergency stopping devices for speeds exceeding 100 fpm; devices shall operate independently of normal terminal stopping devices.

F. Wiring and Electrical Devices: Include all necessary hoistway wiring and electrical devices; include hall panels, pit emergency stop switch, and traveling cables for elevators.

G. Piping: Include all necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit.

2.5 HYDRAULIC JACKS

A. Hydraulic Jacks: Paired, two-stage telescoping hydraulic jacks, one each side of the elevator car, of sufficient size to lift the gross load to the height specified.

1. Cylinders shall be constructed of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each cylinder shall be equipped with a cylinder

head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing.
2. Plungers shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Plungers shall be provided with a stop ring electrically welded to plungers to prevent the plunger from leaving the cylinder.
3. Plungers and cylinders shall be installed plumb and shall operate freely with minimum friction.
4. Factory test jacks to insure adequate strength and freedom from leakage.

B. Hydraulic Oil: Hydraulic oil of type and grade as recommended by the elevator manufacturer.

C. Piping: Piping size, type, weight and fittings recommended by elevator manufacturer and meeting ANSI/ASME A17.1 requirements. Protect underground piping with corrosion resistant coating.

2.6 CAR ENCLOSURE

A. General: Manufacturer’s standard steel-framed car enclosure with roof panel, access doors, power door operator, ventilation, and finishes as indicated.

B. Platform and Sling: Manufacturer’s standard construction of formed steel and structural steel shapes, gusseted and bolted or welded; powder coat finish of manufacturer’s standard color. Floor of Manufacturer’s standard wood or metal panel floor prepared to receive floor finishes indicated on Drawings.

C. Car Enclosure: Provide car enclosure as follows:

1. Side and Rear Wall Panels:

    a. Construction: 14 gauge stainless steel, No. 4 finish at base and exposed surfaces.
    b. Wall Panels: Manufacturer’s standard removable offset wood core panels, plastic laminate face and edges with fire retardant plastic laminate backing, mounted with concealed fasteners from inside of the car. Panels shall have a flame-spread index of 75 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range.

2. Front Walls (Return Panels): Applied stainless steel panels with No. 4 finish, with provisions for signal equipment.
3. Door(s): Hollow metal construction with stainless steel facing, No. 4 finish.
4. Ceiling: Luminous ceiling, LED light tubes, suspended acoustic panel ceiling T-grid members, white
5. Door Sills: Aluminum, mill finish.
6. Handrails: Provide at two sides and rear of car, 1-1/2 inches round or 1/2 by 2 inch flat bar, satin stainless steel with No. 4 finish.
7. Ventilation: Manufacturer’s standard single speed exhaust fan mounted on the car top.

8. Inspection Certificate: Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
9. Hooks: Provide hooks for protective pads and one complete set(s) of full-height protective pads.

D. Car Top Inspection: Provide a car top inspection station with an “Auto-Inspection” switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station will give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

E. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

2.7 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall be hollow metal type and accommodate hoistway wall construction.

B. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Frames: Form frames with 2 inch wide face from stainless-steel sheet having a No. 4 satin finish.
2. Doors: Flush, hollow-metal construction fabricated from stainless-steel sheet having a No. 4 satin finish.
3. Sills: Extruded aluminum, mill finish, with grooved surface, 1/4 inch thick.
4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M for grouting sills.
5. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B and having a fire rating as indicated on Drawings.

6. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

C. Star of Life Symbol: Where indicated, provide Star of Life symbol on both jambs of hoistway entrances on the portion of the frame at right angles to the hallway or landing area; symbols shall be not less than 3 x 3 inches in size and shall be mounted not less than 78 inches or more than 84 inches above the floor level at the threshold. (Ref. 2022 CBC 3002.4.4a, 3002.4.5a, and 3002.4.6a).

D. Floor Designations: Provide floor identification designations at both jambs of each hoistway entrance. Designations shall be provided in both raised characters and Braille. Raised characters shall be 2 inches high.

1. Main Entry Level: A raised star, placed to the left of the floor designation, shall be at the main entry level. The outside diameter of the star shall be 2 inches and all points shall be of equal length.

2. Raised characters, including the star, shall be white on a black background. Braille complying with CBC 11B-703.3 shall be placed below the corresponding raised characters and the star; the braille translation for the star shall be “Main.” Applied plates are acceptable if they are permanently fixed to the jambs.

3. Mounting Height: Mounting height shall be uniform, floor designations shall be 48 inches minimum to the baseline of the Braille text and 60 inches maximum to the baseline of the raised characters.

E. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

F. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.

1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

2.8 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): Compact submerged type in a self-contained unit; the power unit shall include the following:

1. Power unit shall be complete with a structural steel outer base with tank supports, floating inner base for mounting motor and pump assembly, overhead oil reservoir with tank cover and controller compartment with cover.
2. Power unit drive portions shall be mounted within a tank capable of containing the necessary amount of hydraulic fluid for the elevator. The motor shall be isolated from the tank to reduce vibration.
3. Motor: Motor specifically designed for oil-hydraulic elevator service pump; duty rating shall be selected for specified speed and load with a rating of a minimum of 80 starts per hour. Motor shall include an over temperature device that shall open upon exceeding the preset temperature; over temperature device shall be connected into the elevator control circuit to remove the motor from service.
4. Pump: Positive-displacement type pump specifically manufactured for oil-hydraulic elevator service, designed for steady discharge with minimum pulsation to give smooth and quiet operation, and shall be directly coupled to the motor.
5. Hydraulic Control Unit: A compact housing containing the components indicated, suitable for operation under the required pressures, and allowing for components to be accessible and adjustments to be made without removing the assembly from the oil line. Adjustable control valves shall include the following:

a. Relief Valve: Relief valve shall be externally adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
b. Up Start and Stop Valve: Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
c. Check Valve: Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
d. Lowering Valve: Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.

6. Hydraulic Silencer: Manufacturer's standard hydraulic silencer (muffler device) at the power unit location. The silencer shall contain pulsation absorbing material inserted in a blowout proof housing arranged for inspecting interior parts without removing unit from oil line.
7. Power unit shall be factory tested for leaks and noise; valves shall be pre-tuned.
8. Hydraulic Fluid: USDA certified bio-based product, ultra-low toxicity, biodegradable, made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives, that is approved by elevator manufacturer for use with elevator equipment.
9. Piping: Size, type, and weight of piping as recommended by elevator manufacturer for connections between power unit and hydraulic jacks, with fittings and flexible connectors to minimize sound and vibration transmissions from power unit.
10. Wiring: Provide all necessary wiring in accordance with the California Electrical Code and the National Electrical Code.

2.9 DOOR OPERATION

A. Door Operation: Direct current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and the door operating mechanism shall allow for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing.

B. Door Protection Devices: Manufacturer's standard door protection/reopening system for detecting the presence of a passenger or object; if door opening is obstructed, the doors shall immediately reopen.

C. Door noise shall not exceed 58 dBA.

D. Interlocks: Equip each hoistway entrance with an interlock to prevent movement of car away from landing until doors are locked in the closed position and to prevent opening of doors at a landing from the corridor side unless the car is resting at landing or is in the leveling zone and stopping at that landing.

E. Door hangers and Track: Sheave type, two-point suspension hangers and tracks.

1. Sheaves: 3 inch minimum diameter polyurethane tires and sealed ball bearings.
2. Tracks: Drawn steel shaped to conform to hanger sheaves.

F. Gibs: Minimum of two gibs with fire tabs per door panel.

G. Locking: Provide hoistway entrance locking device in accordance with ANSI/ASME A17.1 for each hoistway entrance to allow authorized persons to gain access to hoistway. Provide means for unlocking each hoistway entrance at each landing.

H. Door timer Control System: Door control system shall be designed with separately adjustable timers to control door open time for car and hall calls to suit traffic flow.

I. Sight Guards: Provide sight guards to match finish of entrances.

J. Door Restriction: Provide door restriction in accordance with ANSI/ASME A17.1 for all elevators.

2.10 SIGNALS AND PUSH-BUTTONS

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs.

1. Comply with California Building Code (CBC) accessibility requirements; refer to CBC accessibility requirements referenced in Part 2 “Performance Requirements” Article.
2. Control buttons shall have square shoulders, be 3/4 inch minimum in the smallest dimension and shall be raised 1/8 inch plus or minus 1/32 inch above the surrounding surface. Buttons shall be activated by a detectable mechanical motion (2022 CBC 11B-407.2.1.2).

B. Car Control Stations: Provide manufacturer's standard car control stations subject to compliance with requirements. Mount in return panel adjacent to car door, unless otherwise indicated. Mark buttons and switches for required use or function. Use both tactile symbols and Braille. Car control stations shall include but shall not be limited to the following:

1. Emergency alarm button.
2. Emergency stop switch.
3. Buttons shall be internally illuminated.
4. Raised markings and Braille shall be provided and located to the left-hand side of each push button.
5. Digital car position indicator at the top of and integral to the car operating panel.
6. Door open and close buttons.
7. Light key switch.
8. Fan key switch.
9. Hoistway access key switching.
10. Elevator data plate marked with elevator capacity.

11. Illuminated alarm button with raised markings.
12. Firefighter’s hat.
13. Firefighter’s phase II key switch.
14. Emergency phone.
15. Emergency light with battery back-up and test switch.
16. Telephone cabinet integral to the car station.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

1. System shall comply with ASME A17.1, the U.S. Architectural & Transportation Barriers Compliance Board's "2010 ADA Standards for Accessible Design” and the California Building Code, Chapter 11B.

D. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Provide with audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

E. Hall Push-Button Stations: Manufacturer's standard wall-mounted units, subject to compliance with requirements; provide one hall push-button station at each landing for each elevator. Terminal stations shall have one push-button (Up or down); intermediate stations shall have two pushbuttons, one for up and one for down.

F. Hall Lanterns: Manufacturer’s standard units with illuminated arrows, subject to compliance with requirements, provide single arrow at terminal landings.

G. Hall Annunciator: Provide with each hall lantern, manufacturer’s standard audible signal chime, subject to compliance with requirements, indicating car arrival and direction of travel. Signals sound once for up and twice for down.

2.11 MISCELLANEOUS ACCESSORIES

A. Emergency Pictoral Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

1. Comply with requirements referenced in Part 2 “Performance Requirements” Article and Division 10 Section “Signage.”

B. Inserts: Furnish required concrete inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

2.12 MATERIALS AND FINISHES

A. Steel Plates, Shapes and Bars: ASTM A36.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B.

C. Stainless-Steel Sheet, Strip and Plate: ASTM A 240/A 240M, Type 304, No. 4 satin finish.

D. Aluminum Plate and Sheet: ASTM B 209.

E. Aluminum Extrusions: ASTM B 221, Alloy 6063, mill or clear anodized finish.

F. Plastic Laminate: High-pressure type complying with NEMA LD 3, Grade GP, 0.05 inch thickness, for flat applications and Type BKV for panel backing; color and pattern as selected by Architect from plastic laminate manufacturer's standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator area(s) where elevators are to be installed, including equipment rooms, with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install elevator components in accordance with manufacturer's written instructions, ASME A17.1, and applicable codes and regulations.

B. Sills, struts, hanger supports, hanger covers, and unit frames shall be erected prior to the erection of rough wall and set in proper relation to elevator guides. Doors, facias, an toe guards shall be installed after walls are finished.

C. All wiring and electrical interconnections shall comply with the governing codes. Insulated wiring shall have flame retardant and moisture-proof outer covering, and shall be run in conduit, tubing, or electrical wire ways.

D. Traveling cables shall be flexible and suitably suspended to relieve strain on individual conductors.

E. Traveling cable shall have at a minimum, 10% spares. Include 3 twisted shielded pairs for potential card reader and do not include in spare count.

F. Telephone wiring (twisted pairs) shall be included in the traveling cable.

G. All exposed metal work furnished under this section shall be painted with two coats of enamel by the elevator subcontractor after installation.

H. Furnish and install pit ladder in compliance with elevator code.

I. Deliver keys for all key operated switches to Owner in triplicate. All switches, except fireman's service switches shall be keyed aloike. Key fireman's service switches to code requirements.

J. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

K. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

L. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.

M. Piping: Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cemented fittings.

N. Lubricate operating parts of systems as recommended by manufacturers.

O. Leveling Tolerance: 1/4 inch, up or down, regardless of load and direction of travel.

P. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

Q. Locate hall call and signal equipment for elevators in compliance with accessibility requirements and as follows, unless otherwise indicated:

1. Locate hall push-button stations at location most convenient for approaching passengers unless otherwise indicated.
2. Place hall lanterns either above or beside each hoistway entrance if jamb mounted lanterns are not used.
3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use of elevator (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 CLEANING, PROTECTION, ADJUSTMENT AND REPAIR

A. Elevators shall not be used for construction purposes.

B. Just prior to substantial completion, remove protective masking from finished metal surfaces. Examine panels for damage, replace panels which exhibit damage, deformation, buckling and staining which cannot be corrected to Architect’s satisfaction.

C. Clean all finished surfaces. Refinish or replace components which have become damaged or stained. Perform cleaning work to remove all soil, finger marks and discolorations that may have been caused before or during installation. Soiling that causes permanent discoloration will be cause for rejection of the material on which it occurs.

D. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

E. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Check operation of each elevator with Owner's personnel present and before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include twelve months full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective

components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of not more than twenty-four hours.

END OF SECTION

SECTION 210517 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

SUMMARY

Section Includes:

Sleeves.
Stack-sleeve fittings.
Sleeve-seal systems.
Sleeve-seal fittings.
Grout.
Silicone sealants.

ACTION SUBMITTALS

Product Data: For each type of product.

PRODUCTS

SLEEVES

Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, with plain ends and integral welded waterstop collar.

Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

STACK-SLEEVE FITTINGS

Description: Manufactured, galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

Underdeck Clamp: Clamping ring with setscrews.

SLEEVE-SEAL SYSTEMS

Description:

Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
Designed to form a hydrostatic seal of 20 psig (137 kPa) minimum.
Sealing Elements: High-temperature-silicone interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
Pressure Plates: Carbon steel.
Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

SLEEVE-SEAL FITTINGS

Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

Plastic or rubber waterstop collar with center opening to match piping OD.

GROUT

Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

Packaging: Premixed and factory packaged.

SILICONE SEALANTS

Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.

Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

EXECUTION

SLEEVE INSTALLATION

Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

Sleeves are not required for core-drilled holes.

Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
Cut sleeves to length for mounting flush with both surfaces.

Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

Install sleeves for pipes passing through interior partitions.

Cut sleeves to length for mounting flush with both surfaces.
Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

STACK-SLEEVE-FITTING INSTALLATION

Install stack-sleeve fittings in new slabs as slabs are constructed.

Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."

Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.

Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

Use silicone sealant to seal around the outside of stack-sleeve fittings.

Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

SLEEVE-SEAL-SYSTEM INSTALLATION

Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

SLEEVE-SEAL-FITTING INSTALLATION

Install sleeve-seal fittings in new walls and slabs as they are constructed.

Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

Secure nailing flanges to concrete forms.

Use grout or silicone sealant, to seal the space around outside of sleeve-seal fittings.

FIELD QUALITY CONTROL

Perform the following tests and inspections:

Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

Prepare test and inspection reports.

SLEEVE AND SLEEVE-SEAL SCHEDULE

Use sleeves and sleeve seals for the following piping-penetration applications:

Exterior Concrete Walls above Grade:

Piping Smaller Than NPS 6: Steel pipe sleeves.
Piping NPS 6 and Larger: Steel pipe sleeves.

Exterior Concrete Walls below Grade:

Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

Concrete Slabs-on-Grade:

Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

Concrete Slabs above Grade:

Piping Smaller Than NPS 6: Steel pipe sleeves.
Piping NPS 6 and Larger: Steel pipe sleeves.

Interior Partitions:

Piping Smaller Than NPS 6: Steel pipe sleeves.
Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 210517

SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. BrassCraft Manufacturing Co.
2. Dearborn Brass
3. Jones Stephens Corp.
4. Kennedy Manufacturing Company
5. Mid-America Fittings, Inc.
6. ProFlo

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
    b. Chrome-Plated Piping: One-piece steel or split-plate steel with polished, chrome-plated finish.
    c. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    f. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    g. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

2. Escutcheons for Existing Piping to Remain:

    a. Chrome-Plated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

e. Bare Piping in Unfinished Service Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
f. Bare Piping in Equipment Rooms: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor plate.
2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 210518

SECTION 210523 - GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Indicator posts.
9. Trim and drain valves.

1.3 DEFINITIONS

A. NRS: Nonrising stem.

B. OS&Y: Outside screw and yoke.

C. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed for Fire Protection in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

    a. Level 1: HCBZ - Indicator Posts, Gate Valve.
    b. Level 1: HLOT - Valves.

        1) Level 3: HLUG - Ball Valves, System Control.
        2) Level 3: HLXS - Butterfly Valves.
        3) Level 3: HMER - Check Valves.
        4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

    a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

    a. Indicator posts.
    b. Valves.

        1) Gate valves.
        2) Check valves.

            a) Single check valves.

        3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.

2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 (DN 50) and smaller.

2.2 TWO-PIECE BALL VALVES WITH INDICATORS

A. Manufacturers
   1) Victaulic Co. of America.
   2) Nibco Inc.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear or traveling nut.
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 (DN 25) through NPS 2 (DN 50): Threaded ends.
12. End Connections for Valves NPS 2-1/2 (DN 65): Grooved ends.

2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers
   1) Milwaukee Valve Company
   2) Globe Fire Sprinkler Corp.
   3) Fivalco, Inc.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum: Pressure rating: 175 psig (1200 kPa).
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Bronze, Stainless steel, or with EPDM coating.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 (DN 25) through NPS 2 (DN 50): Threaded ends.
10. Ends Connections for Valves NPS 2-1/2 (DN 65): Grooved ends.

2.4 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers

1) Victaulic Co. of America.
2) Anvil International, Inc.
3) NIBCO Inc.
4) Globe Fire Sprinkler Corp.
5) Kennedy Valve Company
6) Tyco Fire Products LP
7) Fivalco Inc.
8) Zurn Industries, LLC

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Grooved-end connections.

2.5 CHECK VALVES

A. Manufacturers

1) Victaulic Co. of America.
2) Viking Corporation
3) Anvil International, Inc.
4) NIBCO Inc.
5) Reliable Automatic Sprinkler Co., Inc
6) Globe Fire Sprinkler Corporation
7) Kennedy Valve Company

8) Tyco Fire Products LP
9) Fivalco Inc.
10) Zurn Industries, LLC

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.6 BRONZE OS&Y GATE VALVES

A. Manufacturers
1) Milwaukee Valve Company
2) NIBCO Inc.
3) United Brass Works, Inc.
4) Zurn Industries, LLC

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.7 IRON OS&Y GATE VALVES

A. Manufacturers
1) Victaulic Co. of America.
2) NIBCO Inc.
3) Kennedy Valve Company
4) WATTS
5) Mueller Co
6) Hammond Valve
7) American Cast Iron Pipe Company
8) Clow Valve Company
9) Zurn Industries, LLC

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze.
5. Wedge Seat: Cast or ductile iron, or bronze.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.8 NRS GATE VALVES

A. Manufacturers

1) Victaulic Co. of America.
2) NIBCO Inc.
3) Kennedy Valve Company
4) Mueller Co
5) American Cast Iron Pipe Company
6) Clow Valve Company
7) Zurn Industries, LLC

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron.
5. Wedge Seat: Cast or ductile iron, or bronze.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.9 INDICATOR POSTS

A. Manufacturers

1) NIBCO Inc.
2) Kennedy Valve Company
3) Mueller Co
4) American Cast Iron Pipe Company
5) Clow Valve Company

B. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.

2. Type: Underground, Pit or Wall.
3. Base Barrel Material: Cast or ductile iron.
4. Extension Barrel: Cast or ductile iron.
5. Cap: Cast or ductile iron.
6. Operation: Wrench.

2.10 TRIM AND DRAIN VALVES

A. Ball Valves:
1. Manufacturers
    1) Victaulic Co. of America.
    2) NIBCO Inc.
    3) Milwaukee Valve Company
    4) WATTS
    5) Potter Roemer LLC
    6) Tyco Fire Products LP
    7) Fire Protection Products, Inc
    8) Zurn Industries, LLC
    9) Fire-End & Croker Corporation
    10) Red White Valve Corp.

2. Description:

    a. Pressure Rating: 175 psig (1200 kPa.
    b. Body Design: Two piece.
    c. Body Material: Forged brass or bronze.
    d. Port size: Full or standard.
    e. Seats: PTFE.
    f. Stem: Bronze or stainless steel.
    g. Ball: Chrome-plated brass.
    h. Actuator: Handlever.
    i. End Connections for Valves NPS 1 (DN 25) through NPS 2-1/2 (DN 65): Threaded or Grooved ends

B. Angle Valves:
1. Manufacturers
    1) NIBCO Inc.
    2) United Brass Works, Inc.
    3) Fire Protection Products, Inc

2. Description:

    a. Pressure Rating: 175 psig (1200 kPa).
    b. Body Material: Brass or bronze.
    c. Ends: Threaded.
    d. Stem: Bronze.
    e. Disc: Bronze.
    f. Packing: Asbestos free.
    g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:
   1. Manufacturers
      1) NIBCO Inc.
      2) United Brass Works, Inc

   2. Description:

      a. Pressure Rating: 175 psig (1200 kPa).
      b. Body Material: Bronze with integral seat and screw-in bonnet.
      c. Ends: Threaded.
      d. Stem: Bronze.
      e. Disc Holder and Nut: Bronze.
      f. Disc Seat: Nitrile.
      g. Packing: Asbestos free.
      h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:

   1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for application of valves in fire-suppression water-service piping outside the building.
   2. Section 211200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.
   3. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
   4. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.

5. Section 211339 "Foam-Water Systems" for application of valves in AFFF piping.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 210523

SECTION 210529 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 13.

B. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Copper Pipe and Tube Hangers:

1. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
   1. Manufacturers:
      a. Unitstrut
      b. B-Line
      c. Flex-Strut Inc.
      d. G-Strut
      e. Haydon Corporation
      f. Thomas & Betts Corporation
      g. Wesanco, Inc
   2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
   4. Channels: Continuous slotted carbon-steel channel with inturned lips.
   5. Channel Width: Selected for applicable load criteria.
   6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Non-MFMA Manufacturer Metal Framing Systems:
   1. Manufacturers:
      a. Anvil International
      b. Carpenter & Paterson, Inc
      c. Empire Industries, Inc
      d. ERICO International Corporation
      e. PHD Manufacturing, Inc
   2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
   4. Channels: Continuous slotted carbon-steel channel with inturned lips.
   5. Channel Width: Select for applicable load criteria.
   6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.5 THERMAL HANGER-SHIELD INSERTS

A. Manufacturers:

a. Carpenter & Paterson, Inc
b. Clement Support Services
c. ERICO International Corporation
d. National Pipe Hanger Corporation
e. Pipe Shields Inc.
f. Piping Technology & Products, Inc
g. Rilco Manufacturing Co., Inc
h. Value Engineered Products, Inc

B. Insulation-Insert Material: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psi (688-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Threaded Anchors: NFPA-approved, UL-listed, or FM-approved, insert-threaded-type anchors, for use in hardened portland cement concrete over metal deck; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers:
a. ITW Ramset/Red Head – Sammy XP35
2. Indoor Applications: Zinc-coated or Stainless steel.
3. Outdoor Applications: Stainless steel.

2.7 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.8 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M).

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
    d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
    e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use thermal hanger-shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Comply with NFPA requirements.

L. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

M. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION 210529

SECTION 210548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Pipe-riser resilient supports.
5. Resilient pipe guides.
6. Elastomeric hangers.
7. Snubbers.
8. Restraint channel bracings.
9. Seismic-restraint accessories.
10. Mechanical anchor bolts.
11. Adhesive anchor bolts.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development for the State of California.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.

b. Annotate to indicate application of each product submitted and compliance with requirements.

INFORMATIONAL SUBMITTALS

B. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

C. Qualification Data: NICET Water-based Systems Layout III.

D. Welding certificates.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT ACCESSORIES

Through bolts with proper blocking

A. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.

B. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet (12 m)o.c., and longitudinal supports a maximum of 80 feet (24 m)o.c.
3. Brace a change of direction longer than 12 feet (3.7 m).

D. Install seismic-restraint devices using methods approved by **an agency acceptable to authorities having jurisdiction** that provides required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Set through bolts to manufacturer's recommended torque, using a torque wrench.
3. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in "Section 211313 "Wet-Pipe Sprinkler Systems,".

END OF SECTION 210548

SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufactures
   a. Brady Corporation
   b. Brimar Industries, Inc
   c. Carlton Industries, LP
   d. Champion America
   e. Craftmark Pipe Markers
   f. Emedco

g. Kolbi Pipe Marker Co.
h. LEM Products Inc.
i. Marking Services, Inc
j. Seton Identification Products

2. Material and Thickness: Brass, 0.032 inch (0.8 mm), stainless steel, 0.025 inch (0.64 mm), aluminum, 0.032 inch (0.8 mm), or anodized aluminum, 0.032 inch (0.8 mm) thick, with predrilled holes for attachment hardware.
3. Letter Color: Red
4. Background Color: White
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufactures
   a. Brady Corporation
   b. Brimar Industries, Inc
   c. Carlton Industries, LP
   d. Champion America
   e. Craftmark Pipe Markers
   f. Emedco
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc
   j. Seton Identification Products
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) or 1/8 inch (3.2 mm) thick, with predrilled holes for attachment hardware.
3. Letter Color: Red
4. Background Color: White
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
7. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufactures
1. Brady Corporation
2. Brimar Industries, Inc
3. Carlton Industries, LP
4. Champion America
5. Craftmark Pipe Markers
6. Emedco
7. LEM Products Inc.
8. Marking Services, Inc
9. National Marker Company
10. Seton Identification Products
11. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) 1/8 inch (3.2 mm) thick, with predrilled holes for attachment hardware.

C. Letter Color: Red

D. Background Color: White

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

G. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufactures
1. Actioncraft Products, Inc.

2. Brady Corporation
3. Brimar Industries, Inc
4. Carlton Industries, LP
5. Champion America
6. Craftmark Pipe Markers
7. Emedco
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services, Inc
11. Seton Identification Products

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

F. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

2.4 STENCILS

A. Stencils for Piping:

1. Manufactures
   a. Brimar Industries, Inc
   b. Carlton Industries, LP
   c. Champion America
   d. Craftmark Pipe Markers
   e. Kolbi Pipe Marker Co.
   f. Marking Services, Inc

2. Lettering Size: Size letters according to ASME A13.1 for piping.
3. Stencil Material: Aluminum, Brass, Fiberboard, or Metal.
4. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Manufactures
   a. Actioncraft Products, Inc
   b. Brady Corporation
   c. Brimar Industries, Inc
   d. Carlton Industries, LP
   e. Champion America
   f. Craftmark Pipe Markers
   g. Emedco
   h. Kolbi Pipe Marker Co.
   i. LEM Products Inc.
   j. Marking Services, Inc
   k. Seton Identification Products

B. Description: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping-system abbreviation and 1/2-inch (13-mm) numbers.

   1. Tag Material: Brass, 0.032 inch (0.8 mm) or stainless steel, 0.025 inch (0.64 mm) thick, with predrilled holes for attachment hardware.
   2. Fasteners: Brass or Steel wire-link chain or S-hook.
   3. Valve-Tag Color: Safety Red.
   4. Letter Color: White.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

   1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

1. Manufactures
   a. Brady Corporation
   b. Brimar Industries, Inc
   c. Carlton Industries, LP
   d. Champion America
   e. Craftmark Pipe Markers
   f. Emedco
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc
   j. Seton Identification Products

B. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

   1. Size: Approximately 4 by 7 inches (100 by 178 mm).
   2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Fire-Suppression Standpipe: 1-1/2 inches (38 mm), round.
b. Wet-Pipe Sprinkler System: 1-1/2 inches (38 mm), round.
c. Dry-Pipe Sprinkler System: 1-1/2 inches (38 mm), round.
d. Foam-Water System: 1-1/2 inches (38 mm), round.
e. Clean-Agent Fire-Extinguishing System: 1-1/2 inches (38 mm), round.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 210553

SECTION 211100 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fire-suppression water-service piping and related components outside the building and the following:

1. Pipes, fittings, and specialties.
2. Fire-suppression specialty valves.
3. Concrete vaults.
4. Protective enclosures.
5. Alarm devices.

B. Utility-furnished products include water meters that are furnished to the site, ready for installation.

C. Related Requirements:
1. Section 211119 "Fire-Department Connections" for exposed-, flush-, and yard-type, fire-department connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.

C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.

D. Grooved-End, Ductile-Iron Pipe Appurtenances:

1. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

F. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.

1. Gaskets: AWWA C111, rubber.

G. Flanges: ASME B16.1, Class 125, cast iron.

2.2 PVC PIPE AND FITTINGS

A. PVC Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.

B. PVC Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.3 JOINING MATERIALS

A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

2.4 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
2. Standard: AWWA C219.
3. Center-Sleeve Material: Manufacturer's standard
4. Gasket Material: Natural or synthetic rubber.
5. Pressure Rating: 150 psig (1035 kPa) minimum.
6. Metal Component Finish: Corrosion-resistant coating or material.

2.5 CORPORATION VALVES

A. Corporation Valves: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

B. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.6 CURB VALVES

A. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.

B. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

C. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.7 BACKFLOW PREVENTERS

A. Double-Check, Detector-Assembly Backflow Preventers:

1. Febco by Watts
2. Standards: ASSE 1048 and UL's "Fire Protection Equipment Directory" listing
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle one-third of flow range.
5. Size: 4” NPS.
6. Design Flow Rate: 475 gpm.
7. Pressure Loss at Design Flow Rate: 5 psig.
8. Body Material: Ductile iron with Stainless Steel check components
9. End Connections: Flanged.
10. Configuration: Designed for straight through flow.
11. Accessories:

    a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
    b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

2.8 ALARM DEVICES

A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig (1725-kPa) working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with excavating, trenching, and backfilling requirements in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install encasement for piping according to ASTM A 674 or AWWA C105.

F. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

G. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least 36 inches (910 mm) of cover over top.
2. In Loose Gravelly Soil and Rock: With at least 12 inches (300 mm)

H. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

I. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.

1. Terminate fire-suppression water-service piping within the building at 1’-0 above the floor slab. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.

J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

K. Comply with requirements for fire-suppression water-service piping inside the building in the following Sections:

1. Section 211313 "Wet-Pipe Sprinkler Systems

L. Comply with requirements in Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.

B. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

C. Ream ends of tubes and remove burrs.

D. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.

E. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

F. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.

G. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.

H. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139.

I. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

J. Do not use flanges or unions for underground piping.

3.4 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.

6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.

E. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.6 DETECTOR CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.7 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 (DN 65) and larger backflow preventers and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.8 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire-department connection to mains.

B. Install protective pipe bollards on two sides of each freestanding fire-department connection.

3.9 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.

1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:

1. Valves: Install chain and padlock on open OS&Y gate valve.
2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in Section 284621.11 "Addressable Fire-Alarm Systems."

3.10 CONNECTIONS

A. Connect fire-suppression water-service piping to existing water main.

3.11 FIELD QUALITY CONTROL

A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig (zero kPa). Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare test and inspection reports.

3.12 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping.

B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Section 220553 "Identification for Plumbing Piping and Equipment."

3.13 CLEANING

A. Clean and disinfect fire-suppression water-service piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow it to stand for three hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

3.14 PIPING SCHEDULE

A. Underground fire-suppression water-service piping NPS 4 (DN 100) shall be one of the following:

1. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints. (Connections to hydrants and FDC)
2. PVC, Class 150 pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints. (All piping not supplying hydrants or FDC)

B. Aboveground fire-suppression water-service piping NPS 4 shall be the following:

1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

3.15 VALVE SCHEDULE

A. Underground fire-suppression water-service shutoff valves NPS 4 (DN 80) and larger shall be the following:

1. 200-psig (1380-kPa), AWWA, iron, nonrising-stem, metal seated gate valves.

B. Indicator-post underground fire-suppression water-service valves NPS 4 (DN 80) and larger shall be 175-psig (1200-kPa), UL-listed or FM Global-approved, iron, nonrising-stem gate valves with indicator-post flange.

C. Standard-pressure, **aboveground** fire-suppression water-service shutoff valves NPS 4 (DN 80) and larger shall be the following:

1. 200-psig (1380-kPa), AWWA, iron, OS&Y, metal seated gate valves. (DCDA)
2. AWWA butterfly valves. (Riser)

D. Fire-suppression water-service check valves NPS 4 (DN 80) and larger shall be the following:

1. AWWA check valves.
2. UL-listed or FM Global-approved detector check valves.

END OF SECTION 211100

SECTION 211119 – FIRE DEPARTMENT CONNECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exposed-type fire-department connections.
2. Flush-type fire-department connections.
3. Yard-type fire-department connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2 - PRODUCTS

2.1 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufactures
1. American Fire Hose & Cabinet
2. Elkhart Brass Mfg. Co.
3. Fire Protection Products, Inc.
4. Fire-End & Croker Corporation
5. GMR International Equipment Corporation
6. Guardian Fire Equipment, Inc.
7. Venus Fire Protection Ltd.
8. Wilson & Cousins Inc.

B. Standard: UL 405.

C. Type: Exposed, projecting, for wall mounting.

D. Pressure Rating: 175 psig (1200 kPa) minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, wall type.

I. Outlet: Back, with pipe threads.

J. Number of Inlets: Two

K. Escutcheon Plate Marking: Similar to "AUTO SPKR"

L. Finish: Polished chrome plated.

M. Outlet Size: NPS 6 (DN 150)

2.2 FLUSH-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufactures
1. American Fire Hose & Cabinet
2. Elkhart Brass Mfg. Co.
3. GMR International Equipment Corporation
4. Guardian Fire Equipment, Inc.
5. Potter Roemer LLC
6. Venus Fire Protection Ltd.

B. Standard: UL 405.

C. Type: Flush, for wall mounting.

D. Pressure Rating: 175 psig (1200 kPa) minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Rectangular, brass, wall type.

I. Outlet: With pipe threads.

J. Body Style: Horizontal

K. Number of Inlets: Two

L. Outlet Location: Back

M. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE"

N. Finish: Polished chrome plated

O. Outlet Size: NPS 6 (DN 150).

2.3 YARD-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufactures
1. Elkhart Brass Mfg. Co.
2. Fire Protection Products, Inc.
3. Fire-End & Croker Corporation
4. GMR International Equipment Corporation
5. Guardian Fire Equipment, Inc.
6. Potter Roemer LLC
7. Wilson & Cousins Inc.

B. Standard: UL 405.

C. Type: Exposed, freestanding.

D. Pressure Rating: 300 psig (2070 kPa)

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, floor type.

I. Outlet: Bottom, with pipe threads.

J. Number of Inlets: Two

K. Sleeve: Brass

L. Sleeve Height: 18 inches (460 mm).

M. Escutcheon Plate Marking: Similar to "AUTO SPKR"

N. Finish, Including Sleeve: Polished chrome plated.

O. Outlet Size: NPS 6 (DN 150).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-type fire-department connections.

B. Install yard-type fire-department connections in concrete slab support. Comply with requirements for concrete in Section 033000 "Cast-in-Place Concrete."

C. Install two protective pipe bollards on sides of each fire-department connection. Comply with requirements for bollards in Section 055000 "Metal Fabrications."

D. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 211119

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.

1.3 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 300 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.

2. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling include the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

B. Qualification Data: For qualified Installer and professional engineer.

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include

separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems for review by engineer of record for compliance with approved contract documents.

a. Design Responsibility: Preparation of working plans, calculations, and field test reports by a Nicet III or higher designer for conformance with these documents.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager no fewer than three days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13 2022 Edition with State of California Amendments.
2. 2022 California Fire Code

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. High-Pressure Piping System Component: Listed for 300-psig working pressure.

1. Sprinkler system design shall be approved by engineer of record.

a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
b. Sprinkler Occupancy Hazard Classifications:

1) Building Service Areas: Ordinary Hazard, Group 1.
2) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
3) General Storage Areas: Ordinary Hazard, Group 1.
4) Libraries except Stack Areas: Light Hazard.
5) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
6) Office and Public Areas: Light Hazard
7) Classroom Areas: Light Hazard.
8) Chemistry Lab: Ordinary Hazard, Group 2
9) Fire Pump House: Extra Hazard, Group 2

2. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
f. Special Occupancy Hazard: As determined by authorities having jurisdiction.

3. Maximum Protection Area per Sprinkler: According to UL listing.
4. Maximum Protection Area per Sprinkler:

a. Office Spaces: 225 sq. ft..
b. Storage Areas: 130 sq. ft..
c. Mechanical Equipment Rooms: 130 sq. ft..
d. Electrical Equipment Rooms: 130 sq. ft..
e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 40, Black/Stainless-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

D. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

E. Galvanized- and Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.

F. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.

    a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

K. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers:
    a. Victualic Company
    b. Anvil International
    c. Shurjoint Piping Products USA Inc
    d. Tyco Fire Products LP
2. Pressure Rating: 175-psig minimum.
3. Galvanized or Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

L. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

1. Manufacturers:
    a. Victualic Company

2.3 COVER SYSTEM FOR SPRINKLER PIPING

1. Manufacturers:
    a. DecoShield Systems, Inc.

B. Description: System of support brackets and covers made to protect sprinkler piping.

C. Brackets: Glass-reinforced nylon.

D. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.

2.4 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
2. High-Pressure Piping Specialty Valves: 300-psig.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Manufacturers:
    a. Victualic Company
    b. Viking Corporation
    c. Reliable Automatic Sprinkler Co., Inc
2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electric Code, by a qualified testing agency, and marked for intended location and application.

G. Deluge Valves:

1. Manufacturers:

a. Victualic Company
b. Viking Corporation
c. Reliable Automatic Sprinkler Co., Inc

2. Standard: UL 260.
3. Design: Hydraulically operated, differential-pressure type.
4. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
5. Wet, Pilot-Line Trim Set: Include gage to read diaphragm-chamber pressure and manual control station for manual operation of deluge valve, and connection for actuation device.

H. Automatic (Ball Drip) Drain Valves:

1. Manufacturers:
   a. Reliable Automatic Sprinkler Co., Inc
   b. Tyco Fire Products LP
2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.5 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:
1. Standard: UL 213.
2. Pressure Rating: 175-psig minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers:
   a. Victualic Company
   b. Reliable Automatic Sprinkler Co., Inc
   c. Tyco Fire Products LP
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Manufacturers:
    a. Potter Electric Signal Company, LLC
    b. Potter Roemer LLC
    c. Elkhart Brass Mfg. Co., Inc
2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers:
    a. Victualic Company
    b. Viking Corporation
    c. Tyco Fire Products LP
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers:
    a. Aegis Technologies, Inc.
    b. CECA, LLC
    c. Corcoran Piping System Co.
    d. Merit Manufacturing
2. Standard: UL 1474.
3. Pressure Rating: 300 psig.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Manufacturers:
    a. Victualic Company
    b. FlexHead Industries, Inc.
    c. Fivalco Inc.
    d. Gateway Tubing, Inc.
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 300 psig.
5. Size: Same as connected piping, for sprinkler.

2.6 SPRINKLERS

1. Manufacturers:
   a. Victualic Company
   b. Viking Corporation
   c. Reliable Automatic Sprinkler Co., Inc

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: 300 psig.

F. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

G. Sprinkler Finishes: Chrome plated, bronze, brass, or factory painted.

H. Special Coatings: Wax and corrosion-resistant paint.

I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat or Plastic, white finish, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel or Plastic, white finish, one piece, flat.

J. Sprinkler Guards:

1. Manufacturers:
   a. Victualic Company
   b. Viking Corporation
   c. Reliable Automatic Sprinkler Co., Inc
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers:

a. Victualic Company
b. Viking Corporation
c. Tyco Fire Products LP

2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 8-1/2-inches diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

C. Electrically Operated Alarm Bell:

1. Manufacturers:
   a. Potter Electric Signal Company LLC
   b. Notifier
   c. Fire-Lite Alarms, Inc
2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 10-inch diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electric Code, by a qualified testing agency, and marked for intended location and application.

D. Water-Flow Indicators:

1. Manufacturers:
   a. Viking Corporation
   b. System Sensor
   c. Potter Electric Signal Company, LLC
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Manufacturers:
   a. Viking Corporation
   b. System Sensor
   c. Potter Electric Signal Company, LLC
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Manufacturers:
   a. System Sensor
   b. Potter Electric Signal Company, LLC
   c. Kennedy Valve Company
   d. Fire-Lite Alarms, Inc
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electric Code, by a qualified testing agency, and marked for intended location and application.

2.8 MANUAL CONTROL STATIONS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.9 PRESSURE GAGES

A. Manufacturers:
   a. AGF Manufacturing, Inc.
   b. AMETEK, Inc.
   c. Ashcroft Inc
   d. Brecco Corporation
   e. WIKA Instrument Corporation

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 300 psig.

E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 221119 "Domestic Water Piping Specialties."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from EOR. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 and California Building Code requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

N. Fill sprinkler system piping with water.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

O. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 for supports.

3.7 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.8 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.9 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.13 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded or grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

5. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
6. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
6. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

E. High-pressure, wet-pipe sprinkler system, NPS 4 and smaller, shall be one of the following:

1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

F. High-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:

1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with roll-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.14 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers .
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Recessed Sprinklers: Finish as indicated on plans, with corresponding escutcheon.
3. Upright, Pendent, and Sidewall Sprinklers: Finish as indicated on plans in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211313

SECTION 220000
GENERAL PLUMBING PROVISIONS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The preceding General Conditions shall form a part of this Section with the same force and effect as though repeated here. The provisions of this Section shall also apply to Division 22 of these Specifications and shall be considered a part of that Divisions.

1.2 CODES AND REGULATIONS

A. All work and materials shall be in accordance with current rules and regulations of applicable codes. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes. Should the Drawings or Specifications call for material or methods of construction of a higher quality or standard than required by these codes, the Drawings and Specifications shall govern. Applicable codes and regulations include, but are not necessarily limited to, the following:

California Building Code	CCR Title 24, Part 2
California Electrical Code	CCR Title 24, Part 3
California Mechanical Code	CCR Title 24, Part 4
California Plumbing Code	CCR Title 24, Part 5
California Energy Code	CCR Title 24, Part 6
California Fire Code	CCR Title 24, Part 9
Local Codes	

1.3 DEFINITIONS

A. Provide: The term "provide" as used in these specifications or on the drawings shall mean furnish and install.

B. Piping: The term "piping" as used in these specifications or on the drawings shall mean all pipe, fittings, valves, hangers, insulation, etc. as may be required for a complete and functional system.

C. Ductwork: The terms "duct" or "ductwork" as used in these specifications or on the drawings shall mean all ducts, fittings, joints, dampers, hangers, insulation, etc. as may be required for a complete and functional system.

D. Wiring: The term "wiring" as used in these specifications or on the drawings shall mean all wiring, conduit, boxes, connections, transformers, relays, switches etc. as may be required for a complete and functional system.

1.4 PERMITS AND FEES

A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required. All charges are to be included in the work.

1.5 COORDINATION OF WORK

A. Examination: Before starting work, thoroughly examine existing and newly completed underlying and adjoining work and conditions on which the installation of this work depends. Report to the Engineer in writing all conditions which might adversely affect this work.

B. Layout: Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, piping, ductwork, fixtures, equipment, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interference with each other, or with structural, electrical, architectural or other elements.

C. Verification: If discrepancies are discovered between drawing and specification requirements, the more stringent requirement shall apply. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment. No work shall be prefabricated or installed prior to this coordination. No costs will be allowed to the Contractor for any prefabrication or installation performed prior to this coordination. Verify the proper voltage and phase of all equipment with the electrical plans.

D. Location of Utilities Prior to Trenching or Earthwork: The Contractor shall notify the Owner a minimum of two business days prior to beginning trenching or earthwork. Prior to this notification, the Contractor shall have marked all proposed trenches with paint and shall have contacted a utility locating company and have had this company mark all found underground utilities with paint. The Contractor shall then coordinate and arrange for a site visit with the Owner to review the proposed trenching and/or earthwork areas. Trenching and/or earthwork shall not begin until the Owner agrees. Repair and/or compensation for repair of marked utilities is the responsibility of the Contractor. The Owner retains the right to either self-perform the repair or require the Contractor to complete the repair, as directed by the Owner. If while performing the work, the Contractor discovers utilities that have not been marked, the Contractor shall immediately notify the Owner verbally and in writing.

1.6 GUARANTEE

A. Guarantee shall be in accordance with the General Conditions. The Contractor shall repair any defects due to faulty materials or workmanship and pay for any resulting damage to other work which appears within the guarantee period. These Specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with

guarantee periods in excess of that called for in the General Conditions, the certificate of guarantee shall be furnished to the Owner through the Engineer.

1.7 QUIETNESS

A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not transmitted to the structure.

1.8 DAMAGES BY LEAKS

A. The Contractor shall be responsible for damages caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

1.9 EXAMINATION OF SITE

A. The Contractor shall examine the site, compare it with Plans and Specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.10 COMPATIBILITY WITH EXISTING SYSTEMS

A. Any work which is done as an addition, expansion or remodel of an existing system shall be compatible with that system.

1.11 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new unless otherwise noted. Materials and equipment of a given type shall be by the same manufacturer. Materials and equipment shall be free of dents, scratches, marks, shipping tags and all defacing features at time of project acceptance. Materials and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance.

1.12 SUBMITTALS

A. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material or equipment shall not be ordered or installed until written review is processed by the Engineer.

All shop drawings must comply with the following:

1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory. FAX submittals are not acceptable.

2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor, table of contents, and indexed tabs dividing each group of materials or item of equipment. All items shall be identified by the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on drawings.

3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be high-lighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled or detailed.

B. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and features desired. Proposed substitutions shall comply with the Owner’s General Requirements. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items. At the Engineer's request, furnish locations where equipment similar to the substituted equipment is installed and operating along with the user's phone numbers and contact person. Satisfactory operation and service history will be considered in the acceptance or rejection of the proposed substitution.

C. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

1.13 MANUFACTURER'S RECOMMENDATIONS

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

1.14 SCHEDULING OF WORK

A. All work shall be scheduled subject to the review of the Engineer and the Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner. HVAC equipment and functions, whether existing or new, shall be maintained in operating condition whenever the facility is occupied, unless otherwise approved by the Owner.

1.15 DEMOLITION

A. Existing equipment, ducts, piping, etc. noted for removal shall be removed and delivered to the Owner at a location to be determined by the Owner. Those items determined by the Owner to be of no value shall become the property of the Contractor and shall be removed from the job site by the Contractor at the Contractor's expense. Existing piping, ducts, services, etc. requiring capping shall be capped below floors, behind walls, above ceilings or above roof unless otherwise noted. Where items are removed, patch the surfaces to match the existing surfaces.

1.16 HAZARDOUS MATERIAL REMOVAL

A. All hazardous material removal will be by the Owner. Hazardous material is to be removed before the work is started. If the Contractor discovers hazardous material which has not been removed, the Contractor shall immediately cease work in that area and promptly notify the Owner.

1.17 OPENINGS, CUTTING AND PATCHING

A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. Except as noted below, the actual openings and the required cutting and patching shall be provided by other Divisions. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided

under this Division. Patching of these surfaces shall be provided by other Divisions. Cutting or coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

1.18 EXCAVATION AND BACKFILL

A. General: Barrel of pipe shall have uniform support on sand bed. Sand shall be free from clay or organic material, suitable for the purpose intended and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve. Unless otherwise noted, minimum earth cover above top of pipe or tubing outside building walls shall be 24", not including base and paving in paved areas.

B. Excavation: Width of trench at top of pipe shall be minimum of 16", plus the outside diameter of the pipe. Provide all shoring required by site conditions. Where over excavation occurs, provide compacted sand backfill to pipe bottom. Where groundwater is encountered, remove to keep excavation dry, using well points and pumps as required.

C. Backfill:

1. 6" Below, Around, and to 12" Above Pipe: Material shall be sand. Place carefully around and on top of pipe, taking care not to disturb piping, consolidate with vibrator.

2. One Foot Above Pipe to Grade: Material shall be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to review by Engineer.

D. Compaction: Compact to density of 95% within building and under walkways, driveways, traffic areas, paved areas, etc. and to 90% elsewhere. Demonstrate proper compaction by testing at top, bottom and one-half of the trench depth. Perform these tests at three locations per 100' of trench.

1.19 CONTINUITY OF SERVICES

A. Existing services and systems shall be maintained except for short intervals when connections are made. The Contractor shall be responsible for interruptions of services and shall repair damage done to any existing service caused by the work. If utilities not indicated on the drawings are uncovered during excavation, the Contractor shall notify the Engineer immediately.

1.20 PROTECTIVE COATING FOR UNDERGROUND PIPING

A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total

thickness, X-Tru-Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. John-Mansville. Protective coating shall be extended 6" above surrounding grade.

1.21 ACCESS DOORS

A. Provide access doors as required where equipment, piping, valves, ductwork, etc. are not otherwise accessible. Access doors shall match the wall or ceiling finish and fire rating as indicated on the Architectural drawings. 16-gage steel frame and 14-gage steel door with paintable finish, except in ceramic tile, where door shall be 16-gage stainless steel with satin finish. Continuous hinge. Deliver doors to the General Contractor for installation. Milcor. Unless otherwise noted, the minimum sizes shall be as follows:

1 valve up to 1-1/2"	12" x 12"
1 valve up to 3"	16" x 16"

1.22 CONCRETE ANCHORS

A. As specified and detailed on approved drawings, steel stud with expansion wedge requiring a drilled hole – powder driven anchors are not acceptable. Minimum spacing shall be 12 diameters center to center and 10 diameters center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the ICC Evaluation Service Report (ESR) values. Minimum concrete embedment shall be the nominal embedment listed in the ESR table. Hilti Kwik Bolt TZ2.

1.23 EQUIPMENT ANCHORING AND OTHER SUPPORTS

A. Mechanical systems (equipment, ductwork, piping, conduit, etc.) shall be anchored in accordance with the CBC. All systems mounted on concrete shall be secured with a concrete anchor at each mounting point. All air handlers shall be mounted on spring isolators. Secure base plate as indicated above. Attachment of equipment, ductwork, piping, conduit, etc. supported on curbs or platforms shall be made to the side of curbs and platforms, where possible. Where screws or lag bolts must be installed through the top of a sheet metal cap, the installation shall be as follows. Pre-drill pilot hole. Fill pilot hole with polyurethane sealant. Install screw or lag bolt with a flat washer and an EPDM washer adjacent to the sheet metal.

1.24 SUPPORTS AND SEISMIC RESTRAINTS

A. Any structural element required to hang or support piping, ducts or equipment provided under this Division and not shown on other drawings shall be provided under this Division.

B. Mechanical systems (equipment, ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with the CBC. Supports and restraints shall be provided as detailed on plans. Restraint system shall be Mason West, Inc. (OSHPD OPM 0043-13).

1.25 PAINTING

A. Paint all black iron supports, hangers, anchors, etc. with two coats of rust resisting primer. Also paint all uninsulated black iron piping exposed to weather with two coats of rust resisting primer.

1.26 ROOF PENETRATIONS AND PATCHING

A. Whenever any part of the mechanical systems penetrates the roof or exterior wall, the openings shall be flashed and counter-flashed water tight with minimum 22 gauge galvanized sheet metal. Flashing shall extend not less than eight inches from the duct, pipe, or supporting member in all directions unless detailed otherwise. All roof penetrations and patching shall be in accordance with the recommendations of the National Roofing Contractor's Association and the Owner’s roofing standards.

1.27 SYSTEM IDENTIFICATION

A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by pre-printed markers or stenciled marking, and include arrows to show direction of flow. Pre-printed markers shall be the type that wrap completely around the pipe, requiring no other means of fastening such as tape, adhesive, etc. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portions of lines. Marking of short branches and repetitive branches for equipment connections is not required.

B. Below Grade Piping: Bury a continuous, pre-printed, bright-colored, metallic ribbon marker capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6” to 8” below finished grade.

C. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-4). Provide 1/2" high lettering - white on black background. Nameplates shall be permanently secured to the exterior of the unit.

D. Valves: Provide brass valve tags with brass hooks or chains on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Prepare and submit a tagged-valve schedule, listing each valve by tag number, location and piping service. Deliver to Owner through the Engineer.

1.28 CLEANING

A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work. This includes but is not limited to building surfaces, piping, equipment and ductwork, inside and out. Surfaces shall be free of dirt, grease, labels, tags, tape, rust, and all foreign material.

1.29 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Printed: Three copies of Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts list for all faucets, trim, valves, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-3). All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Pumps, Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included.

B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instructions that apply to the control system. The Engineer's office shall be notified 48 hours prior to this meeting.

C. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed and verbal) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.30 RECORD DRAWINGS

A. The Contractor shall obtain one set of prints for the project, upon which a record of all construction changes shall be made. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. building, curbs, walks. In addition, the water, gas, sewer, under floor duct, etc. within the building shall be recorded by offset distances from building walls. An electronic copy of the original drawings will be made available to the Contractor. The Contractor shall transfer the changes, notations, etc. from the marked-up prints to the electronic copy. The record drawings (marked-up prints, electronic drawings disc and a hard copy) shall be submitted to the Engineer for review.

1.31 ACCEPTANCE TESTING

A. The Contractor shall perform, document and submit all acceptance testing as required by California Code of Regulations, Title 24, Part 6.

END OF SECTION

SECTION 220050
PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Division.

1.2 GENERAL MECHANICAL PROVISIONS

A. The preceding General Mechanical Provisions shall form a part of this Division with the same force and effect as though repeated here.

1.3 SCOPE

A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Sanitary sewer system.
2. Domestic water system.
3. Fuel gas system.
4. Storm drain system (including rainwater leaders).
5. Drain system (including condensate drain).
6. All equipment as shown or noted on the drawings or as specified.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Sanitary Sewer:

a. Soil, Waste and Vent Piping: Inside Building and Within Five Feet of Building Walls: Standard weight coated cast iron pipe and fittings, CISPI 301, or hub end with rubber gaskets, ASTM A74, ASTM C564. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute as manufactured by Tyler, AB&I or Charlotte. Heavy-duty shielded couplings, Type 304 stainless steel, with neoprene gasket, ASTM C1540. Husky HD 2000, Clamp-All 80. Mission HeavyWeight MG

Couplings are also acceptable. Size 2" and smaller above grade may be standard weight galvanized steel, ASTM A120/A53, with coated cast iron recessed drainage fittings, ANSI B16.12. 2" and smaller exposed to view shall be galvanized steel, ASTM A120/A53, with coated cast iron recessed drainage fittings, ANSI B16.12. Fixture and equipment drains exposed to view in kitchens shall be DWV copper, recessed drainage fittings, 95-5 solder.

1. Cleanouts: Comparable models of Josam, Wade or Zurn are acceptable. Floor Cleanouts: Smith 4028 with nickel bronze top in finished areas; Smith 4228 in utility areas. Wall Cleanouts: Smith 4532 with stainless steel cover and screw. Pipe Cleanouts: Iron body with threaded brass plug.

2. Cleanout Box: Precast reinforced concrete. Cast iron lid marked for service. Christy F22 in foot traffic areas; G5 in roadways.

B. Storm Drain (Including Rain Water Leader, RWL):

1. Piping: Inside Building and Within Five Feet of Building Walls: Same as Soil, Waste and Vent Piping, except as otherwise noted on drawings. Where exposed to view on exterior of building, piping shall be galvanized steel with recessed drainage fittings.

C. Water and Gas:

1. Cold Water Piping:

a. Inside Building, Within Five Feet of Building Walls, and All Above Grade:

1) Schedule 40 galvanized steel pipe, ASTM A120/A53. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3.

-or-

2) Hard temper seamless copper, ASTM B88. Wrought copper fittings, ANSI B16.22. Type L with brazed joints (1100F, min.). 1-1/2" and smaller above grade may be soldered, 95-5 tin-antimony solder. All nipples shall be red brass (85% copper). Above grade fittings may be copper (1/2” to 2”) or bronze (2-1/2” to 4”) press fittings, ASME B16.18 or ASME B16.22. EPDM O-rings. Installation shall be in accordance with the manufacturer’s installation instructions. Nibco, ProPress.

b. Outside Building - Below Grade:

1) Same as Inside Building. Galvanized steel shall have protective coating.

-or-

2) 3" and Smaller: Schedule 40 Polyvinyl chloride (PVC) with solvent weld fittings where approved by administrative

authority.

2. Hot Water Piping:

   a. Inside Building - Above Slab: Same as Cold Water Piping - Inside Building.

   b. Outside Building or Below slab: Pre-insulated. Type L copper core. 1" foamed polyurethane insulation. Polyvinyl chloride jacket. Sealed ends. Rubber ring internal slip joint. Fittings shall be wrought copper, with brazed joints (1100F, min.). Ricwil, Thermal Pipe Systems.

3. Gas Piping:

   a. Inside Building and All Above Grade: 2" and Smaller: Schedule 40 galvanized steel pipe, ASTM A120/A53. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3, ANSI B31.8. Flexible connections shall be convoluted yellow brass with dielectric couplings, AGA approved. 2-1/2" and larger: Schedule 40 black steel pipe, ASTM A120/A53. Standard weight carbon steel welding fittings, long radius ells, ANSI B16.9.

   b. Inside Building - Below Grade to Five Feet Outside Building: Same as Inside Building and All Above Grade. Provide sleeves and vents acceptable to administrative authority.

   c. Outside Building - Below Grade: Polyethylene pipe and fittings, ASTM D2513. PolyPipe GDY 20, PE 2406/2708. Otherwise, piping shall be coated schedule 40 steel.

4. Valves and Specialties:

   a. Valves:

      1) General: Manufacturer's model numbers are listed to complete description. Equivalent models of Crane, Grinnell, Milwaukee, Nibco, Stockham or Walworth are acceptable. All valves of a particular type or for a particular service shall be by the same manufacturer. All valves in potable water piping shall be “lead free.” Butterfly valves may be substituted for 2-1/2" and larger gate valves above grade; see specification below. Use full port ball valve for 2” and smaller water shutoff valves; see specification below.

      2) Gate Valve: 2" and Smaller: All bronze. Rising stem. Union bonnet. Wedge disk. Malleable iron handwheel. 200 psi WOG. Stockham B-105. 2-1/2" and Larger: Iron body, bronze mounted. Non-rising stem. Wedge disk. 200 psi

WOG. Flanged or AWWA hub end as applicable. Stockham G-612. Underground valves shall have square operating nut. Provide one operating "T" handle for underground valves.

3) Butterfly Valve: Iron threaded lug body. Aluminum bronze disk. O-ring seals. Resilient, removable seat. 416 stainless steel shaft. 6" and smaller valves shall have multi-position lever handle. 8" and larger valves shall have gear operator. Provide 2" extension neck at insulated pipes. Demco Series NE, Grinnell, Stockham

4) Check Valve: 2" and Smaller: All bronze swing check, regrinding. 200 psi WOG. Stockham B-319.

5) Ball Valve: Full port. Bronze body, cap, stem, disk and ball. Screwed connection. Lever handle. TFE seat. O-ring seals. 300 psi WOG. Apollo, Grinnell, Jomar.

6) Plug Valve: Valves in gas piping systems must be UL listed for gas distribution. 4" and Smaller: Eccentric bronze or nickel plated semi-steel plug. Semi-steel body. Bronze bushings. Buna-N-rings. 175 psi WOG. DeZurik Series 400. 1-1/2" and smaller natural gas valves may be full port ball valves. Apollo, Jomar, Grinnell.

7) Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy G5 in roadways (use B-9 for ball valves).

c. Miscellaneous Specialties:

1) Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination temperature and pressure relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.

2) Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Grinnell. Size 2-1/2" and Larger: Grooved pipe, synthetic gasket, malleable iron housing. Victaulic Style 77, Type "E" gasket, Grinnell.

3) Dielectric Coupling: Insulating union or flange rated for 250 psig. EPCO.

4) Shock Absorber: Multiple bellows. Seamless copper chamber approved for concealed installations. Designed

and applied in accordance with PDI WH201. Sioux Chief, Watts.

5) Flexible Connection: Corrugated bronze core covered with high tensile bronze tubular braid. 150 psi working pressure. 2" and smaller shall have screwed connections. 2-1/2" and larger shall have flanged connections. Flexonics, Keflex.

D. Drain Piping (including Condensate): Copper Type L as specified above for inside building cold water piping.

E. Miscellaneous Piping Items:

1. Pipe Support:

a. Pipe Hanger: Steel "J" hanger with side bolt for piping 4" and smaller; steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Hanger and rod shall have galvanized finish. B-Line, Grinnell, Unistrut.

b. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph above. Increase hanger size per manufacturer's recommendation. B-Line, Semco, Superstrut.

c. Construction Channel: 12-gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Grinnell, Unistrut.

2. Flashing: Vent flashing shall be 4 lb/ft2 lead, 16" sq. flange, length sufficient to be turned down 2" into vent. Oatey. Flashing for other piping through roof shall be prefabricated galvanized steel roof jacks with 16" sq. flange. Provide clamp-on storm collar and seal water tight with mastic. For cold process built-up roof, material shall be 4 lb/ft^2 lead instead of galvanized steel.

2.2 PIPING INSULATION MATERIALS

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Pre-Molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 50F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping, thickness shall be 1" for pipe sizes 3/4" and less; 1-1/2" thickness for pipe

sizes 1" and larger. Certainteed, Knauf, Johns-Manville, Owens-Corning.

C. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-F at a mean temperature of 50F. 1-1/2" thickness. Knauf, Johns-Manville, Owens-Corning.

D. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Zeston.

E. Stretchable Glass Fabric: Reinforcing mesh. 10 X 20 continuous filament glass yarns per inch. Johns-Manville.

F. Vapor Barrier Coating: Childers CP-30, Foster 30-25.

G. Lagging Adhesive: Childers CP-50A, Foster 30-36.

H. Outdoor Mastic: Childers CP-21, Foster 65-05.

I. Insulating Tape: Ground virgin cork and synthetic elastomeric. Black, odorless, and non-toxic. K factor 0.43 Btu-in/hr-ft2-F or less. Non-shrinking. For outdoor use, provide protective finish by same manufacturer. Halstead.

J. Molded Closed Cell Vinyl (Piping Insulation Under Disabled Accessible Lavatories and Sinks): Fully molded closed cell vinyl, 3/16" thick. Internal ribs on drain insulation to provide air gap. Thermal conductivity shall not exceed 1.17 BTU-in/hr-ft^2-°F at an average temperature of 73°F. Weep hole in cleanout nut enclosure. Out of sight nylon fastening system. Hinged cap over valve to allow access for servicing. Truebro Lav-guard.

2.3 FIXTURES

A. General: Provide rough-in for and install all plumbing fixtures shown on drawings. Except in equipment rooms, all trim, valves and piping not concealed in wall structure, above ceiling or below floors, shall be brass with polished chrome plate finish, unless noted otherwise. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.

B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures and trim. Manufacturer's model numbers are listed to complete description. Equivalent models of American Standard, Eljer, Elkay, Haws, Kohler or T&S Brass are acceptable. For drainage fixtures, equivalent models of Josam, Smith or Zurn are acceptable. Maximum force to operate any fixture controls shall not exceed 5 lbs.

C. Stops and P-Traps: All fixtures shall be provided with stops and P-Traps as applicable. Wall mounted faucets, valves, etc. shall have integral stops or wall mounted stops.

1. Stops: All hot and cold water supplies shall be 1/2" I.P.S. inlet angle stops with stuffing box, loose key lock shield, and brass riser (3/8" for 2-1/2 gpm and less, otherwise 1/2"). McGuire, Speedway.

2. P-Traps: Semi-cast brass, ground joint. 17-gage. Clean-out plug. Unobstructed waterway. California Tubular, McGuire.

2.4 EQUIPMENT

A. General Requirements:

1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.

2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.

3. Ratings:

a. Electrical: Electrical equipment shall be in accordance with NEMA standards and UL or ETL listed where applicable standards have been established.

b. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and be approved by AGA.

4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.

5. Electrical:

a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.

b. Wiring: Conductors, conduit, and wiring shall be in accordance with

Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.

c. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring. .

B. Water Heater: Gas fired, Condensing, Power-Direct Vent. Glass lined tank with magnesium anode protection. 150 psi working pressure. Fully insulated. Automatic temperature control. 100% safety shut-off. High limit control. Provide ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. CSA (US) approved. A.O. Smith, Rheem, Bradford-White.

C. Water Heater: Electric. Tankless point-of-use instant hot water heater. Cast aluminum housing, celcon waterways and nichrome coils. Maximum 150 psi rating. UL listed. Chronomite, Eemax.

D. Circulating Pump: In-line centrifugal. Aluminum housing. All parts exposed to fluid, stainless steel. Water lubricated ceramic shaft and bearings. Epoxy encapsulated windings. Grundfos. -Or- Bronze body, brass impeller. Mechanical seals. Bronze sleeve bearings. Integral thermal overload protection. Bell and Gossett, Taco, Thrush.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. General:

1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by the Engineer. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Vertical lines shall be installed to allow for building settlement without damage to piping. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Provide secondary drain piping where required.

2. Joints:

a. Threaded: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.

b. Welded or Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Welding or brazing shall be performed by a Certified Welder or Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.

c. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.

d. Electrical Equipment: Piping shall not be run over electrical panels, motor control centers or switchboards.

3. Fittings and Valves:

a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.

b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.

c. Unions: A union shall be installed on the leaving side of each valve, at all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.

d. Valves: All valves shall be full line size. Provide shut-off valve for each building and each equipment connection. Provide shut-off valve at each point of connection to existing piping. At equipment connections, valves shall be full size of upstream piping, except that gas valves within 18" of the point of connection to the equipment may be the same size as the equipment connection.

e. Valve Accessibility: All valves shall be located so that they are easily accessible. Valves located above ceilings shall be installed within 24" of the ceiling. Refer to specification 200000 for access requirements.

4. Pipe Support:

a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the

beam. Vertical piping shall be supported with riser clamp at 20' on center (maximum). Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. Copper piping systems which protrude through a surface for connection to a fixture stop or other outlet shall be secured with a drop ell, Grinnell No. 9788; nipple through surface shall be threaded brass.

1) Pressure Pipe:

Pipe Size (Inches)	Maximum Spacing* Between Supports (ft.)		
	Copper	Sch. 40 steel	Plastic
1/2	6	6	4
3/4	6	8	4
1	6	8	4
1-1/4	6	10	4
1-1/2	6	10	4
2	10	10	4
2-1/2	10	10	4
3	10	10	4
4	10	10	4

*Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves or other fittings. Plastic piping shall be supported per the manufacturer's recommendations. Seismic requirements may reduce maximum spacing.

2) Gravity Drain Pipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.

b. Hot and Cold Water Piping: All hot and cold water piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.

c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used as detailed on plans.

5. Miscellaneous:

a. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.

b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and

pipe for piping 3" and smaller, otherwise 2" annular clearance. Piping through walls below grade shall be sealed with Link-Seal.

c. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of the fire authority having jurisdiction.

d. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.

e. Thermometer or Pressure Gage Tap: Provide tee for instrument well. Minimum size of pipe surrounding well shall be 1-1/2".

f. Exposed Pipe at Fixtures: Piping extending from finished surfaces into a finished room shall be chrome plated brass, except under kitchen sinks in commercial kitchens.

B. Sanitary Sewer Piping:

1. General: Where inverts are not indicated, sanitary sewer piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch. Bell and spigot piping shall be installed with barrel on sand bed; excavate hole for bell.

2. Cleanouts: Install cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface.

3. Vents: Vents shall terminate not less than 6" above the roof nor less than 24" from any vertical surface nor within 10' of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2' minimum from gutters, parapets, ridges and roof flashing.

C. Storm Drain (Including Rain Water Leader, RWL): Similar to Sanitary Sewer.

D. Water Piping: Connections to branches and risers shall be made from top of main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Minimum pipe size shall be 3/4", unless otherwise noted. Exposed fixture stops and flush valves shall be installed with brass nipples for copper piping and galvanized nipples for galvanized piping. Nipples are to extend from outside of wall to fitting at header or drop behind finish wall surfaces. Pipe nipples shall be same size as stop or flush valve. Provide shut off for each building and each connection to equipment. Shock absorbers shall be installed in a vertical position per manufacturer’s instructions and per PDI-WH 201 where flush valves, metering faucets or other fast acting valves are

connected to the domestic piping system. Only equipment mounted on vibration isolators shall be connected with flexible connections. Underground hot water and cold water piping which run parallel to each other shall be installed a minimum of 3 feet apart.

E. Gas Piping: Installation shall comply with CPC and NFPA 54 (National Fuel Gas Code). Shall be pitched to drain to dirt legs at low points. No unions shall be installed except at connections to equipment. Provide shutoff and dirt leg at each equipment connection. Only equipment mounted on vibration isolators shall be connected with flexible connectors. Under floor piping shall be sleeved and vented. Underground Polyethylene pipe and butt fusion fittings shall be joined in accordance with manufacturer's recommendations. Metal to plastic transition fittings shall be installed at all transitions. Provide 14-gage insulated tracer wire secured to pipe at 10' intervals with nylon ties. Terminate tracer 6" above grade at both ends.

F. Drain Piping (Including Condensate): Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide TEE with clean-out plug at all changes of direction. Provide trap at each air handling unit to prevent air leakage. Only equipment mounted on vibration isolators shall be connected with flexible connection. Piping not concealed in wall structure, above ceilings or below floors shall be chrome plated brass.

G. PVC Piping: Shall be cut square and assembled prior to solvent weld. Apply primer per manufacturer's recommendations. Coat male joint fully with solvent, make joint before solvent dries and wipe exterior clean.

3.2 PIPING INSULATION INSTALLATION:

A. Domestic Hot Water:

1. General: All domestic hot water piping, fittings and accessories shall be insulated.

2. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied pressure sealing tape.

3. Fittings and Valves:

a. Wrap all fittings and valves with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Solvent weld. Seal all joints with factory supplied pressure sealing vapor barrier tape with 1-1/2" (min.) overlap on both sides of joint. Insulate valves to stem. Do not insulate unions, flanges or valves unless water temperature exceeds 140ºF or the piping is exposed to weather.

b. For miscellaneous fittings and accessories for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the Contractor may cover the fiberglass blanket with stretchable glass fabric, one coat of lagging adhesive and a final coat of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.

4. Additional Finish for Exposed Piping and Equipment: All piping and equipment exposed to view but protected from the weather shall be given an additional finish of PVC jackets.

B. Cold Water Piping-Freeze Protection: All cold water piping exposed to weather shall be wrapped with insulating tape, 50% overlap. Cover valves to stem. Apply at least two coats of protective finish.

C. Piping Insulation Under Disabled Accessible Lavatories and Sinks: Hot and cold water piping, hot and cold water stop and drain piping under disabled accessible lavatories and sinks shall be insulated with 3/16" thick molded closed cell vinyl to prevent accidental injury due to contact or temperature extremes. Installation shall be in accordance with manufacturer's instructions. There shall be no sharp or abrasive surfaces under disabled accessible lavatories and sinks.

3.3 FIXTURE INSTALLATION

A. Fixture Height: Shall be as indicated on Architectural drawings.

B. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor, and adjusted to proper height to drain. Cover openings during construction to keep all foreign matter out of drain line.

C. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Lavatories shall be supported with concealed arm supports. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. "Sanitary 1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).

D. Floor Mounted Fixtures: Shall be provided with proper support plates. Grout at the floor with waterproof ceramic tile grout.

E. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.

3.4 EQUIPMENT INSTALLATION

A. General: It shall be the responsibility of the equipment installer to insure that no work done under other specification sections shall in any way block, or otherwise

hinder the equipment. All equipment shall be securely anchored in place.

B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

3.5 TESTS AND ADJUSTMENTS

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Engineer. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.

B. Gravity Systems:

1. Sanitary Sewer: All ends of the sanitary sewer system shall be capped and lines filled with water to the top of the highest vent, 10' above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.

2. Storm Drain (Including Rainwater leader): Similar to Sanitary Sewer.

3. Drains (Including Condensate): Similar to Sanitary Sewer.

C. Pressure Systems:

1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made.

2. Domestic Hot and Cold Water Piping: Maintain 100 psig water pressure for 4 hours.

3. Gas Piping: Maintain 100 psig air pressure for 4 hours.

3.6 DISINFECTION

A. Disinfect all domestic water piping systems in accordance with AWWA Standard C651, "AWWA Standard for Disinfecting Water Mains", and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by a representative of the Engineer. During procedure signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected

for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner through the Engineer.

END OF SECTION

SECTION 230100
GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section covers and applies to all work included in Divisions 21 through 25.

B. Work in this Section includes providing labor, materials, equipment, services necessary, fabrication, installation and testing for fully operational and safe systems including all necessary materials, appurtenances and features whether specified or shown in the contract documents or not, in conformity with all applicable codes and authorities having jurisdiction for the following:

1. Mechanical work covered by all sections within Divisions 22 and 23 of the specifications, including, but not limited to:

a. Heating, ventilating and air conditioning systems and equipment.

b. Plumbing systems and equipment.

c. Control systems.

d. Testing and balancing.

C. Provide cutting and patching, for the Mechanical Work.

D. Provide piping from plumbing terminations, 10 feet from equipment, for water, gas, sanitary sewer and waste.

E. Provide drain piping for all equipment requiring drainage to floor drains, roof, sink, or funnel drains.

1.3 RELATED WORK AND REQUIREMENTS

A. Carefully check the documents of each section with those of other sections and Divisions. Ascertain the requirements of any interfacing materials or equipment being furnished and/or installed by those sections and Divisions, and provide the proper installation and/or required interface.

1.4 QUALITY ASSURANCE

A. Supply all equipment and accessories in compliance with the applicable standards listed in article 1.6 of this section and with all applicable national, state and local codes.

B. All items of a given type shall be the products of the same manufacturer, unless otherwise specified herein.

1.5 SUBMITTALS

A. Submit shop drawings, product data, samples and certificates of compliance required by Division 01.

B. Product Data Submittals: Submit manufacturers standard published data. Mark each copy to identify applicable products, models, options, accessories and other data. Supplement manufacturers standard data to provide information specific to this project.

C. Organize submittals in sequence according to Specification Section. Submit in single electronic PDF document with tabs identifying each Specification Section. Provide Table of Contents identifying the Specification Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package by Division at one time. Do not submit individual Sections piecemeal.

D. In addition to the submittal requirements of Divisions 22 and 23, submit product data for the following items per the provisions Division 01:

1. All Equipment and Fixtures indicated in Schedules on Drawings.

2. Access panels

E. If more than two submissions are required (initial submittal and one resubmittal) based on rejection or lack of compliance by submittal, then the Contractor shall:

1. Arrange for additional reviews by the Design Engineers.

2. Pay all costs for such additional reviews.

F. Corrections or comments made on the shop drawings during review do not relieve the Contractor from compliance with requirements of the drawings and specifications. Shop drawing checking by the Engineer is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for:

1. Confirming and correlating all quantities and dimensions.

2. Selecting fabrication processes and techniques of construction.

3. Coordinating his work with that of all other trades.

4. Performing his work in a safe and satisfactory manner.

G. Substitutions:

1. Prior to Bid shall be in accordance with Division 01.

2. After award of contract, submit separate substitution request for each substitution in accordance with the requirements hereinbelow. Support each request with:

a. Complete data substantiating compliance of proposed substitution with requirements stated in Contract documents.

b. Data relating to changes in construction schedule.

c. Any effect of substitution on other Work in this and other Divisions, and any other related contracts, and changes required in other work or products.

3. Contractor shall be responsible at no extra cost to Owner for any changes resulting from proposed substitutions which affect work of other Sections or Divisions, or related contracts.

4. Claims for additional costs caused by substitution that may subsequently become apparent shall be met by the Contractor.

5. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.

6. Substitutions will not be considered for acceptance when acceptance will require revision of Contract Documents, unless Contractor bears cost of redesign.

a. Arrange for required redesign by Engineer.

b. Pay all costs for such redesign.

c. All subject to Architect's approval.

7. Approval of substitutions shall not relieve Contractor from full compliance with requirements of Contract documents.

H. As-built (Record) Drawings:

1. Shall be in accordance with Division 01.

2. Provide after installation is complete. Final signoff and Client acceptance will not occur prior to submission of As-built drawings to Architect/Engineer.

3. Indicate as-built conditions and all revisions, fully illustrating all revisions made by all trades in the course of work.

4. Dimension physical locations of ductwork, and piping with reference elevations and distances above finished floors, below beams, from wall faces, underground (invert elevations) and from column lines.

5. Exact location, type and function of concealed valves, dampers, controllers, piping, air vents, piping drains and isolators.

6. Indicate all equipment sizes and capacities and tag numbers.

7. Provide drawing on reproducible bond.

8. These drawings shall be for as-built record purposes for the Owner's use and are not considered shop drawings.

I. Operating Instructions, Maintenance Manuals and Parts Lists:

1. Before requesting acceptance of work, submit one set for review by Architect/Engineer.

2. After review, furnish two (2) printed and bound sets.

3. Include:

a. Installers name, address, telephone number and representatives name, and website address.

b. Manufacturer's name, model number, service manual, spare-parts list, and descriptive literature for all components, cross referenced and numbered on Record Drawings, and in accordance with Title 24 as required.

c. Maintenance instructions.

d. Listing of possible breakdown and repairs.

e. Instruction for starting, operation and programming.

f. Detailed and simplified one line, color coded flow and wiring diagram.

g. Field test report, including:

1) Instrument set points.

2) Normal operating values.

h. Name, address and phone number of contractors equipment suppliers and service agencies.

i. Assemble manufacturer's equipment manuals in chronological order, following the specification alpha-numeric system, in heavy duty 3-ring binders clearly titled on the spine and front cover with appropriate index dividers.

J. Special Tools:

1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of this Division.

2. "Special tools": those not normally found in possession of mechanics or maintenance personnel.

3. Tag each item and cross reference in Maintenance Manual.

4. Turn over to Owner's representative or temporarily secure to unit at Architect's instruction.

K. Quantity of Submittals Required:

1. Product Data (brochures):

a. Submit electronic PDF copy of product data.

b. If comments are required, comment sheet(s) will be returned with submittal.

2. Samples:

a. Submit as required in each specification section.

1.6 REFERENCE STANDARDS

A. Reference standards of industry organizations, manufacturer associates and professional associations that publish standards of construction and/or materials that are referenced in this Division are listed in Division 01. The Standards as referenced in this Specification shall be considered as attached and binding to the requirements of the Construction Documents. The Contractor is to be considered as knowledgeable of these Standards and their requirements for the performance of the Work.

1.7 CODE COMPLIANCE

A. In addition to complying with all other legal requirements, comply with current

provisions of governing codes and regulations in effect during progress of the Work, and with the following:

1. Drawings and specification requirements shall govern where they exceed Code and Regulation requirements.

2. Where requirements between governing Codes and Regulations vary, the more restrictive provisions shall apply.

3. Nothing contained in Contract Documents shall be construed as authority or permission to disregard or violate legal requirements. The Contractor shall immediately draw the attention of the Architect to any such conflicts noted in the Contract Documents.

1.8 DESCRIPTION OF BID DOCUMENTS

A. General:

1. Words or phrases such as "The Contractor shall," "shall be," "furnish," provide," “connect,” "a," "an," "the," and "all" etc. may be omitted for brevity.

2. The Drawings and Specifications are complimentary each to the other. Where discrepancies occur between the Drawings and Specifications, the more stringent provisions shall apply.

3. Examine all drawings and specifications prior to bidding the work. Report any discrepancies to the Engineer.

B. Specifications:

1. Specifications, in general, describe quality and character of materials and equipment and the Standards that govern. Contractor is responsible for design and construction costs incurred for equipment and materials other than the Basis of Design, including but not limited to architectural, structural, electrical, HVAC, fire sprinkler and plumbing.

2. Specifications are of simplified form and include incomplete sentences.

C. Drawings:

1. Drawings in general are diagrammatic and indicate scope, sizes, routing, locations, connections to equipment and methods of installation, but not necessarily offsets, obstructions or structural conditions. Drawings are not intended to show every item, fitting, transition or offset in its exact dimension or detail of equipment or proposed system layout. Locations on drawings may be distorted for purposes of clearness and legibility.

2. Contractor to provide additional offsets, fittings, hangers, supports, valves, drains as required for construction and coordination with work of other trades.

3. Before proceeding with work, ordering or fabricating materials, check and verify all dimensions and carefully check space requirements with other Work to ensure that all equipment and materials can be installed in spaces allotted.

4. Contractor to assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.

5. The Contractor is responsible for installing the work in such a manner that it will conform to the structure and architectural elements, avoid obstructions, maintain headroom, leave adequate clearance for proper maintenance and repairs, and provide clearances and access required by codes. Do not scale distances off of mechanical drawings. Use actual field measured building dimensions.

6. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.

7. Above items to be performed at no additional cost to the Owner.

D. Typical details, where shown on the drawings, apply to each and every item of the project where such items are applicable. Typical details are not repeated in full on the plans, and are diagrammatic only, but with the intention that such details shall be incorporated in full.

1.9 DEFINITIONS

A. "Piping": pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

B. "Motor Controllers": manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.

C. "Control" or "Actuating Devices": automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

1.10 JOB CONDITIONS

A. Adjoining work of other Divisions shall be examined for interferences and conditions affecting this Division.

B. Examine site related work and surfaces before starting work of any Section.

1. Report to Architect, in writing, conditions which will prevent proper provision of this work.

2. Beginning work of any Section without reporting unsuitable conditions to Architect constitutes acceptance of conditions by Contractor.

3. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to Owner.

C. Connections to existing work.

1. Unknown conditions will be addressed if reasonable.

2. Contractor shall field verify existing dimensions prior to ordering or fabricating materials.

3. Install new work and connect to existing work with minimum interference to existing facilities.

4. Temporary shutdowns of existing services:

a. At no additional charges.

b. At times not to interfere with normal operation of existing facilities.

c. Provide 48 hour notification.

5. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.

6. Restore existing disturbed work to original condition.

D. Removal and relocation of existing work.

1. Disconnect, remove or relocate material, equipment, plumbing fixtures, piping and other work noted and required by removal or changes in existing construction.

2. Where existing pipes, conduits and/or ducts which are to remain prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits and/or ducts.

3. Provide new material and equipment required for relocated equipment.

4. Plug or cap active piping or ductwork behind or below finish.

5. Do not leave long dead-end branches. Cap or plug as close as possible to active line.

6. Remove unused piping, ductwork and material.

7. Dispose of removed fixtures and equipment as directed.

8. Turn over removed fixtures and equipment to Owner as directed.

E. Special Traffic Requirements:

1. Maintain emergency and service entrances useable to pedestrian, truck, and ambulance traffic at all times.

2. Where trenches are cut, provide adequate bridging for above-mentioned traffic.

1.11 TEMPORARY FACILITIES

A. See Division 01 for temporary facilities required.

1.12 SCHEDULE OF WORK

A. Arrange work to conform to schedule of construction established or required to comply with Contract Documents.

B. In scheduling, anticipate means of installing equipment through available openings in structure.

C. Confirm in writing to Architect, within 30 days of signing of contract, anticipated number of days required to perform test, balance, and acceptance testing of mechanical systems:

1. This phase must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.

2. Submit for approval at this time, names and qualifications of test and balancing agencies to be used.

1.13 NOISE REDUCTION

A. Cooperate in reducing objectionable noise or vibration caused by mechanical systems.

1. To extent of adjustments to specified and installed equipment and appurtenances.

B. Correct noise problems caused by failure to install work in accordance with Contract Documents. Include labor and materials required as result of such failure.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. Size for proper access, adjusting and maintenance:

1. 12 in. x 12 in. minimum for valves, trap primers, shock absorbers, etc.

2. 24 in. x 24 in. for man access to concealed fans, coils, etc., unless indicated otherwise.

B. Provide as required by work in this Division.

C. Style, Color and Finish to match adjacent construction and as approved by Architect.

PART 3 - EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.2 CUTTING AND PATCHING

A. All carpentry, cutting and patching to be done under trades doing that work. Work shall be done in accordance with Division 01.

B. Provide all carpentry, cutting and patching required for proper installation of material and equipment specified in Divisions 22 and 23.

C. Do not cut, notch or drill structural members without consent of Architect.

D. All cutting and repairing shall conform to Title 21 of California Administrative Code.

3.3 CONCRETE ANCHORS

A. Steel bolt with expansion anchor requiring a drilled hole – powder driven anchors are not acceptable.

B. Minimum concrete embedment shall be 4-1/2 diameters unless otherwise noted on plans.

C. Minimum spacing shall be 12 diameters center to center and 6 diameters center to edge of concrete unless otherwise noted on plans.

D. Maximum allowable stresses for tension and shear shall be 80% of the ICBO test report values. Hilti, Simpson.

3.4 EQUIPMENT ANCHORING

A. All equipment shall be securely anchored in accordance with CBC.

B. All equipment mounted on concrete shall be secured with a concrete anchor as specified above at each mounting point.

C. Secure base plate as indicated above.

3.5 SUPPORTS AND SEISMIC RESTRAINTS

A. All mechanical systems (all ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with Mason West Industries OPM 43-0013 and in accordance with CBC.

3.6 WATER PROOFING

A. Under General Construction Work.

B. Where any work pierces waterproofing, installation shall be subject to review.

1. Provide all necessary sleeves, caulking, flashing and flashing fittings required to make openings absolutely watertight.

C. Flashing:

1. Mechanical Contractor shall provide flashing for all work in this Division, unless otherwise provided by roofing installer, as required to accommodate roof slope, roofing material, and roof installation method. No additional costs will be paid for lack of familiarity of Contractor with roofing type or slope.

2. Mechanical Contractor shall be responsible for coordinating size of penetrations and locations with roofing contractor.

3. Mechanical Contractor shall be responsible for scheduling installation of piping and other penetrations through roof structural system to exterior that they are complete and secure for the orderly installation of the roofing system.

4. 4 lb. lead.

5. 16 oz. lead coated copper.

6. No.22 USSG aluminum.

7. Fittings for piping through roof:

a. Galvanized cast iron bottom recess roof type.

b. Similar to Josam No. 26440 or No. 26450.

D. Provide weather protection canopies, hoods or enclosures over out-of-door equipment which could be damaged by exposure to weather.

1. This requirement applies to:

a. Motors and drives.

b. Controls.

c. Instruments.

2. Identify items under such covers if entirely enclosed.

3.7 ACCESS TO VALVES AND EQUIPMENT

A. Access shall be possible where valves, expansion joints, fire dampers, motors, filters, control devices, and any other equipment requiring access for servicing, repairs, or maintenance are located in walls, soffits, chases, and/or above ceilings.

B. Definition of Accessible:

1. Valves and dampers may be operated.

2. Control devices may be adjusted.

3. Fire dampers may be reset.

4. Equipment access panels may be opened.

5. Normal maintenance work such as replacement of filters, lubrication of bearings, etc., may be performed readily within arm's reach of access opening.

6. It shall not be necessary to crawl through furred ceiling space to perform such operations.

C. Install piping, equipment and accessories to permit easy access for maintenance.

D. Group concealed valves, expansion joints, controls, dampers and equipment requiring service access, so as to be freely accessible through access doors and to minimize the number of access doors required.

E. Relocate piping equipment and accessories as required, at no extra cost to afford proper maintenance access.

F. Coordinate location of access panels with applicable trades installing walls or ceiling.

1. Coordinate panel locations with lights and other architectural features.

2. Submit proposed panel locations to Architect for review.

G. Arrange for location and marking of removable tiles in splined ceilings where access panels are not installed.

H. Existing Structures:

1. When installation requires access openings through existing construction, coordinate location of necessary access panels, and arrange for respective trades to provide openings and framing which may be required.

2. Restore adjoining existing surfaces to original condition after new access panels have been installed.

3.8 CLEANING AND ADJUSTING

A. Work to be painted: Brush and clean work prior to concealing, painting and acceptance. Perform in stages if directed.

B. Painted or exposed work soiled or damaged: Clean, repair and paint to match adjoining work before final acceptance.

C. Remove debris from inside and outside of materials and equipment.

D. Flush out piping after installation.

E. Adjust valves and automatic control devices.

F. Traps, wastes and supplies: unobstructed.

3.9 FIELD QUALITY CONTROL

A. Refer to Division 01.

B. Tests:

1. Perform as specified in individual Divisions, and as required by authorities having jurisdiction.

C. Furnish written report and certification that tests have been satisfactorily

completed.

D. Repair or replace defective work, as directed.

E. Pay for restoring or replacing damaged work due to tests, as directed.

F. Pay for restoring or replacing damaged work of others, due to tests, as directed.

3.10 TRAINING

A. Provide training by qualified manufacturers' representatives for equipment as specified in this Division.

B. Training to include:

1. Site-specific training.

2. Minimum hours as specified in each Section.

3. Training materials (minimum six sets).

4. Electronic media available from the manufacturer [two (2) copies].

C. Each training session to be scheduled with Owner at least 30 days in advance.

END OF SECTION

SECTION 230500
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Equipment installation requirements common to equipment sections.
7. Painting and finishing.
8. Concrete bases.
9. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Mechanical sleeve seals.
2. Access doors

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

   1. Manufacturers:

a. Eslon Thermoplastics.
b. Approved equivalent.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.
b. Approved equivalent.

C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.
b. Approved equivalent.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Carbon steel or Stainless steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. PVC Pipe: ASTM D 1785, Schedule 40.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

2.8 ACCESS DOORS

A. Size for proper access, adjusting and maintenance:

1. 12 in. x 12 in. minimum for valves, volume dampers, etc.
2. 24 in. x 24 in. for man access to concealed fans, coils, fire/smoke dampers, etc., unless indicated otherwise.

B. Provide as required by work in Division 21, 22, 23, and 25.

C. Style, color, and finish to match adjacent construction and as approved by Architect.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.

        1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2-1/2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 ACCESS TO VALVE AND EQUIPMENT

A. Access shall be possible where valves, expansion joints, fire dampers, motors, filters, control devices, and any other equipment requiring access for servicing, repairs, or maintenance are located in walls, soffits, chases, and/or above ceilings.

B. Definition of Accessible:

1. Valves and dampers may be operated.
2. Control devices may be adjusted.
3. Fire dampers may be reset.
4. Equipment access panels may be opened.
5. Normal maintenance work such as replacement of filters, lubrication of bearings, etc., may be performed readily within arm's reach of access opening.
6. It shall not be necessary to crawl through furred ceiling space to perform such operations.

C. Install piping, equipment and accessories to permit easy access for maintenance.

D. Group concealed valves, expansion joints, controls, dampers and equipment requiring service access, so as to be freely accessible through access doors and to minimize the number of access doors required.

E. Relocate piping equipment and accessories as required, at no extra cost to afford proper maintenance access.

F. Coordinate location of access panels with applicable trades installing walls or ceiling.

1. Coordinate panel locations with lights and other architectural features.
2. Submit proposed panel locations to Architect for review.

G. Arrange for location and marking of removable tiles in splined ceilings where access panels are not installed.

3.6 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer’s written instructions, according to seismic codes at Project, and per anchorage details on plans.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.10 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with

indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be DC electronic commutation type (ECM) specifically designed for fan applications. Prewired to the specific voltage and phase. Internal motor shall convert AC supplied to the fan to DC power to operate the motor. Motor shall be controllable down to 20% of full speed. Speed shall be controlled by either potentiometer dial mounted on the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

B. Bearings: Permanently lubricated, heavy duty ball bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 230519
METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Trerice, H. O. Co.
b. Weiss Instruments, Inc.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: Glass or plastic.

8. Stem: Aluminum or brass and of length to suit installation.

a. Design for Air-Duct Installation: With ventilated shroud.
b. Design for Thermowell Installation: Bare stem.

9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flo Fab Inc.
b. Miljoco Corporation.
c. Palmer Wahl Instrumentation Group.
d. Tel-Tru Manufacturing Company.
e. Trerice, H. O. Co.
f. Weiss Instruments, Inc.
g. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES or CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.

11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMETEK, Inc.; U.S. Gauge.
    b. Ashcroft Inc.
    c. Ernst Flow Industries.
    d. Flo Fab Inc.
    e. Tel-Tru Manufacturing Company.
    f. Trerice, H. O. Co.
    g. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    h. Weiss Instruments, Inc.
    i. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Brass or Stainless steel.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston or porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids (except steam).

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of chiller.
2. Inlet and outlet of boiler.
3. Inlet and outlet of each hydronic coil in air-handling units.

L. Install pressure gages in the following locations:

1. Air Handler filters.

2. Suction and discharge of each pump

3.2 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of chiller shall be the following:

1. Industrial-style, liquid-in-glass type.

B. Thermometers at inlet and outlet of boiler shall be the following:

1. Industrial-style, liquid-in-glass type.

C. Thermometers at inlet and outlet of each hydronic coil shall be one of the following:

1. Compact-style, liquid-in-glass type.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 deg F and minus 20 to plus 50 deg C.

B. Scale Range for Heating, Hot-Water Piping: 30 to 240 deg F and 0 to plus 115 deg C.

3.4 PRESSURE-GAGE SCHEDULE

A. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be the following:

1. Test plug with EPDM self-sealing rubber inserts.

B. Pressure gages at suction and discharge of each pump shall be the following:

1. Sealed, direct-mounted, metal case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 psi.

B. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.

END OF SECTION

SECTION 230523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Iron, single-flange butterfly valves.
3. High-performance butterfly valves.
4. Iron, center-guided check valves.
5. Eccentric plug valves.
6. Chainwheels.

B. Related Sections:

1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.

4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Hammond Valve.
d. Legend Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Conbraco Industries, Inc.; Apollo Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Division.
   d. DeZurik Water Controls.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Tyco Valves & Controls; a unit of Tyco Flow Control.
   i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: 200 psig.
   c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
   d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
   e. Seat: EPDM.
   f. Stem: One- or two-piece stainless steel.
   g. Disc: Aluminum bronze.

2.4 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 150, Single-Flange, High-Performance Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Crane Co.; Crane Valve Group; Flowseal.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. DeZurik Water Controls.
   d. Hammond Valve.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Tyco Valves & Controls; a unit of Tyco Flow Control.

2. Description:

   a. Standard: MSS SP-68.
   b. CWP Rating: 285 psig at 100 deg F.

c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: Carbon steel, cast iron, ductile iron, or stainless steel.
e. Seat: Reinforced PTFE or metal.
f. Stem: Stainless steel; offset from seat plane.
g. Disc: Carbon steel.
h. Service: Bidirectional.

2.5 IRON, CENTER-GUIDED CHECK VALVES

A. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.
d. Tyco Fire Products LP; Grinnell Mechanical Products.
e. Muessco

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
c. NPS 14 to NPS 24, CWP Rating: 250 psig.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Style: Compact wafer.
f. Seat: Bronze.

2.6 ECCENTRIC PLUG VALVES

A. 175 CWP, Eccentric Plug Valves with Resilient Seating.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Clow Valve Co.; a division of McWane, Inc.
b. DeZurik Water Controls.
c. Homestead Valve; a division of Olson Technologies, Inc.
d. M&H Valve Company; a division of McWane, Inc.
e. Milliken Valve Company.
f. Henry Pratt Company.
g. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-108.

b. CWP Rating: 175 psig minimum.
c. Body and Plug: ASTM A 48/A 48M, gray iron; ASTM A 126, gray iron; or ASTM A 536, ductile iron.
d. Bearings: Oil-impregnated bronze or stainless steel.
e. Ends: Flanged.
f. Stem-Seal Packing: Asbestos free.
g. Plug, Resilient-Seating Material: Suitable for potable-water service unless otherwise indicated.

2.7 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.

2. Attachment: For connection to ball and butterfly valve stems.

3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc coating.

4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for ball and butterfly valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or butterfly or plug valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service except Steam: ball, or butterfly valves.
4. Pump-Discharge Check Valves:
    a. NPS 2-1/2 and Larger: Iron center-guided, metal-seat check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 CHILLED-WATER AND HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: Shall have threaded ends.

2. Ball Valves: Two piece, full port, bronze with bronze or stainless-steel trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.

3. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze disc.
4. High-Performance Butterfly Valves: Class 150, single flange.

5. Iron, Center-Guided Check Valves: Class 150, compact-wafer, metal seat.

6. Eccentric Plug Valves: 175 CWP, resilient seating.

END OF SECTION

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.3 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
3. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
4. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
5. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. C-Clamps (MSS Type 23): For structural shapes.
5. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Freestanding and restrained spring isolators.
3. Spring hangers with vertical-limit stops.
4. Pipe riser resilient supports.
5. Resilient pipe guides.
6. Restrained vibration isolation roof-curb
7. Restraining braces and cables.

1.2 PERFORMANCE REQUIREMENTS

A. As Indicated on the Construction Drawings:

1.3 SUBMITTALS

A. Product Data: For each product indicated.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Mason Industries.
4. Vibration Eliminator Co., Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene or rubber.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

E. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

F. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

G. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Micrometl.
2. California Dynamics Corporation.
3. Canfab.
4. Kinetics Noise Control.
5. Mason Industries.
6. Thybar Corporation.

B. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.

C. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch-thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

a. Resilient Material: Oil- and water-resistant standard neoprene.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.3 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Mason Industries.
5. TOLCO Incorporated; a brand of NIBCO INC.
6. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

F. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
3. Brace a change of direction longer than 12 feet (3.7 m).

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

G. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test each type and size of installed anchors and fasteners as indicated on the drawings.
2. Test to 90 percent of rated proof load of device.
3. Measure isolator restraint clearance.
4. Measure isolator deflection.
5. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.
5. Warning tags.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/2 inch (13 mm). Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/2 inch (13 mm). Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.

C. Label Content: Include equipment's Drawing designation or unique equipment number, and Room number of primary space served (where thermostat is located). Coordinate with District to match final installed room numbering.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, and pipe size.
   1. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.

C. Pipe Label Color Schedule:

1. Chilled-Water Piping:

   a. Background Color: White.
   b. Letter Color: Blue.

2. Heating Water Piping:

   a. Background Color: White.
   b. Letter Color: Red.

3. Refrigerant Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Chilled Water: 1-1/2 inches, round.
   b. Refrigerant: 1-1/2 inches, round.
   c. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Color:

   a. Chilled Water: Natural.
   b. Refrigerant: Natural.

c. Hot Water: Natural.

3. Letter Color:

a. Chilled Water: Black.
b. Refrigerant: Black.
c. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.
b. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:

a. Variable-flow hydronic systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Certified TAB reports.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB with a minimum of 10 years of successful testing, adjusting, and balancing experience.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine operating safety interlocks and controls on HVAC equipment.

O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB’s “Procedural Standards for TAB,” and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

    a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from [Architect] [or] [Construction Manager] [or] [Commissioning Authority] and comply with requirements in Division 23 Section "Hydronic Pumps."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

    a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.

4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presettings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR HEAT EXCHANGERS

A. Measure water flow through all circuits.

B. Adjust water flow to within specified tolerances.

C. Measure inlet and outlet water temperatures.

D. Check settings and operation of safety and relief valves. Record settings.

3.11 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.12 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator[and condenser] to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
6. Capacity: Calculate in tons of cooling.
7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.13 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.14 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

    a. Rooms with Multiple Supply Outlets: 0% to plus 10% of air flow rate in CFM for whole room indicated on drawings.

3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.15 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.16 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.

7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches (mm), and bore.

i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Filter static-pressure differential in inches wg (Pa).
f. Preheat-coil static-pressure differential in inches wg (Pa).
g. Cooling-coil static-pressure differential in inches wg (Pa).
h. Heating-coil static-pressure differential in inches wg (Pa).
i. Outdoor airflow in cfm (L/s).
j. Return airflow in cfm (L/s).
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch (mm) o.c.
f. Make and model number.
g. Face area in sq. ft. (sq. m).
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.

d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.

e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

I. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

K. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

L. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.17 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.

2. Check the following for each system:

    a. Measure airflow of at least 10 percent of air outlets.
    b. Measure water flow of at least 5 percent of terminals.
    c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    d. Verify that balancing devices are marked with final balance position.
    e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
3. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
4. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.18 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

END OF SECTION

SECTION 230700
HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Flexible elastomeric.
b. Mineral fiber.

2. Fire-rated insulation systems.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied jackets.
10. Tapes.
11. Securements.

B. Related Sections:

1. Division 22 Section "Plumbing Insulation."
2. Division 23 Section "Metal Ducts" for duct liners.
3. Division 23 Section “Underground Hydronic Piping.”

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Aeroflex USA Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. CertainTeed Corp.; Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; All-Service Duct Wrap.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Johns Manville; Micro-Lok.
    b. Knauf Insulation; 1000 Pipe Insulation.
    c. Manson Insulation Inc.; Alley-K.
    d. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ, K=0.23 Btu-in/hr-ft^2-°F at 75 °F mean temperature. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1 or 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; FlameChek.
    b. Johns Manville; Firetemp Wrap.
    c. 3M; Fire Barrier Wrap Products.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Aeroflex USA Inc.; Aeroseal.
    b. Armacell LCC; 520 Adhesive.
    c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-52.
    b. Foster Products Corporation, H. B. Fuller Company; 81-42.
    c. Marathon Industries, Inc.; 130.
    d. Mon-Eco Industries, Inc.; 11-30.
    e. Vimasco Corporation; 136.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products, Division of ITW; CP-76-8.
    b. Foster Products Corporation, H. B. Fuller Company; 95-44.
    c. Marathon Industries, Inc.; 405.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Vimasco Corporation; Elastafab 894.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto PVC Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.

3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; Metal Jacketing Systems.
b. PABCO Metals Corporation; Surefit.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.

c. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    b. Compac Corp.; 104 and 105.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    b. Compac Corp.; 110 and 111.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    b. Compac Corp.; 130.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    d. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    b. Compac Corp.; 120.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Products; Bands.
    b. PABCO Metals Corporation; Bands.
    c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.

4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy or 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from aluminum, at least 0.050 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

    1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
    2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
    3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

    1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, return and outdoor air.
2. All Outdoor concealed and exposed supply and return.

B. Items Not Insulated:
1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Round and rectangular, supply-air and return-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density, R-5.6.

3.13 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.14 PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1/2 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

B. Chilled Water:

1. NPS 6 and Smaller: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.

b. Mineral-Fiber, Preformed Pipe, Type I, 1 inch thick.

C. Heating-Hot-Water Supply and Return, 200 Deg F and below:

1. NPS 6 and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 2 inch thick.

D. Refrigerant Suction and Hot-Gas Piping and Flexible Tubing:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.

3.15 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. PVC: 20 mils thick.

3.16 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. Aluminum, Stucco Embossed with Z-Shaped Locking Seam: 0.016 inch thick.

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SECTION 230800
COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 ALLOWANCES

A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing shall be covered by the Commissioning Authority.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.6 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.7 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.

1.8 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.

4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC&R Contractor, testing and balancing Contractor and HVAC&R Instrumentation and Control Contractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Section "Direct Digital Control System for HVAC." Assist the CxA with preparation of testing plans.

B. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 23 piping Sections. HVAC&R Contractor shall prepare a pipe

system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

C. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

D. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

E. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION

SECTION 230923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 DESCRIPTION

A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.

B. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet.
The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.

C. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms specified in Sequence of Operations shall be BACnet objects.

1.3 APPROVED CONTROL SYSTEM MANUFACTURERS

A. The following are approved control system suppliers, manufacturers, and product lines:

Supplier	Manufacturer	Product Line
ACCS	Automated Logic Corporation	WebCTRL
Pacific West Controls, Inc.	Automated Logic Corporation	WebCTRL
American Building Automation	Automated Logic Corporation	WebCTRL
Sunbelt Controls	Automated Logic Corporation	WebCTRL

The above list does not indicate order of preference. Inclusion on this list does not guarantee acceptance of products or installation. Control systems shall comply with the terms of this specification.

1. The Contractor shall use only operator workstation software, controller software, custom application programming language, and controllers from the corresponding manufacturer and product line unless Owner approves use of multiple manufacturers.
2. Other products specified herein (such as sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.4 QUALITY ASSURANCE

A. Installer and Manufacturer Qualifications

1. Installer shall have an established working relationship with Control System Manufacturer.
2. Installer shall have successfully completed Control System Manufacturer’s control system training. Upon request, Installer shall present record of completed training including course outlines.

1.5 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to the receipt of bids of the following codes:

1. California Building Code (CBC)
2. California Mechanical Code (CMC)
3. California Electrical Code (CEC)
4. ANSI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for Building Automation and Control Systems

1.6 SYSTEM PERFORMANCE

A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer’s recommended hardware and software for operator workstation (server and browser for web-based systems).

1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec.and shall automatically refresh every 15 sec.
3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 45 sec.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.
9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.

10. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

Table-1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5ºC (±1ºF)
Ducted Air	±0.5ºC (±1ºF)
Outside Air	±1.0ºC (±2ºF)
Dew Point	±1.5ºC (±3ºF)
Water Temperature	±0.5ºC (±1ºF)
Delta-T	±0.15º (±0.25ºF)
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see Note 2)
Electrical	±1% of reading (see Note 3)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO2)	±50 ppm

Note 1: Accuracy applies to 10%–100% of scale
Note 2: For both absolute and differential pressure
Note 3: Not including utility-supplied meters

Table 2
Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0–1.5 kPa (0–6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1.0ºC (±2.0ºF)	
Duct Temperature	±1.5ºC (±3ºF)	
Humidity	±5% RH	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1.0 in. w.g.)	MPa (1–150 psi) 0–12.5 kPa (0–50 in. w.g.) differential

1.7 SUBMITTALS

A. Product Data and Shop Drawings: Meet requirements of Section 01 30 00 on Shop Drawings, Product Data, and Samples. In addition, the contractor shall provide shop drawings or other

submittals on hardware, software, and equipment to be installed or provided. No work may begin on any segment of this project until submittals have been approved for conformity with design intent. Provide drawings as AutoCAD 2006 (or newer) compatible files on magnetic or optical disk (file format: .DWG, .DXF, .VSD, or comparable) and three 11" x 17" prints of each drawing. When manufacturer's cutsheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawing shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Submittals shall be provided within 12 weeks of contract award. Submittals shall include:

1. DDC System Hardware

    a. A complete bill of materials to be used indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
    b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:

        i. Direct digital controllers (controller panels)
        ii. Transducers and transmitters
        iii. Sensors (including accuracy data)
        iv. Actuators
        v. Valves
        vi. Relays and switches
        vii. Control panels
        viii. Power supplies
        ix. Batteries
        x. Operator interface equipment
        xi. Wiring

    c. Wiring diagrams and layouts for each control panel. Show termination numbers.
    d. Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware. Riser diagrams showing control network layout, communication protocol, and wire types.

2. Central System Hardware and Software

    a. A complete bill of material of equipment used indicating quantity, manufacturer, model number, and relevant technical.
    b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:

        i. Central Processing Unit (CPU) or web server
        ii. Monitors
        iii. Keyboards

iv. Power supplies
v. Battery backups
vi. Interface equipment between CPU or server and control panels
vii. Operating System software
viii. Operator interface software
ix. Color graphic software
x. Third-party software

c. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show interface wiring to control system.
d. Network riser diagrams of wiring between central control unit and control panels.

3. Controlled Systems

a. Riser diagrams showing control network layout, communication protocol, and wire types.
b. A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.
c. A schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
d. An instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
e. A mounting, wiring, and routing plan-view drawing. The design shall take into account HVAC, electrical, and other systems' design and elevation requirements. The drawing shall show the specific location of all concrete pads and bases and any special wall bracing for panels to accommodate this work.
f. A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.
g. A point list for each control system. List I/O points and software points specified in Section 23 09 93. Indicate alarmed and trended points.

4. Quantities of items submitted shall be reviewed but are the responsibility of the Contractor.
5. Description of process, report formats, and checklists to be used in Section 23 09 23 Article 3.17 (Control System Demonstration and Acceptance).
6. BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.

B. Schedules

1. Within one month of contract award, provide a schedule of the work indicating the following:

a. Intended sequence of work items
b. Start date of each work item
c. Duration of each work item
d. Planned delivery dates for ordered material and equipment and expected lead times
e. Milestones indicating possible restraints on work by other trades or situations

2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

C. Project Record Documents. Upon completion of installation, submit three copies of record (as-built) documents of the documents shall be submitted for approval prior to final completion and shall include:
1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD 2006 (or newer) compatible files on magnetic or optical media (file format: .DWG, .DXF, .VSD, or comparable) and as 11" x 17" prints.
2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of Section 23 09 23 Article 3.17 (Control System Demonstration and Acceptance).
3. Operation and Maintenance (O&M) Manual.
4. As-built versions of submittal product data.
5. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
6. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
7. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
8. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
9. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
10. Graphic files, programs, and database on magnetic or optical media.
11. List of recommended spare parts with part numbers and suppliers.
12. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
13. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
14. Licenses, guarantees, and warranty documents for equipment and systems.
15. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

D. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training. Engineer will modify course outlines and materials if necessary to meet Owner's needs. Engineer will review and approve course outlines and materials at least three weeks before first class.

1.8 WARRANTY

A. Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.
2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. If the engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, the engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve the contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.
5. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.

1.9 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:

1. Graphics
2. Record drawings
3. Database
4. Application programming code
5. Documentation

1.10 DEFINITIONS

Term	Definition
BACnet Interoperability Building Blocks (BIBB)	A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBS are combined to build the BACnet functional requirements for a device in a specification.

Term	Definition
BACnet/BACnet Standard	BACnet communication requirements as defined by the latest version of ASHRAE/ANSI 135 and approved addenda.
Control Systems Server	A computer(s) that maintain(s) the systems configuration and programming database.
Controller	Intelligent stand-alone control device. Controller is a generic reference to building controllers, custom application controllers, and application specific controllers.
Direct Digital Control	Microprocessor-based control including Analog/Digital conversion and program logic.
Gateway	Bi-directional protocol translator connecting control systems that use different communication protocols.
Local Area Network	Computer or control system communications network limited to local building or campus.
Master-Slave/Token Pass-	Data link protocol as defined by the BACnet standard.
Point-to-Point	Serial communication as defined in the BACnet standard.
Primary Controlling LAN	High speed, peer-to-peer controller LAN connecting BCs and optionally AACs and ASCs. Refer to System Architecture below.
Protocol Implementation Conformance Statement	A written document that identifies the particular options specified by BACnet that are implemented in a device.
Router	A device that connects two or more networks at the network layer.
Wiring	Raceway, fittings, wire, boxes and related items.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
B. Install new wiring and network devices as required to provide a complete and workable control network.
C. Use existing Ethernet backbone for network segments marked "existing" on project drawings.
D. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

E. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Section 23 09 93. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.

F. Workstations, Building Control Panels, and Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight saving and standard time as applicable.

G. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

H. System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards specified by the Web Services Interoperability Organization(WS-I) Basic Profile 1.0 or higher. Web services support shall as a minimum be provided at the workstation or web server level and shall enable data to be read from or written to the system.

1. System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.
2. System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.
3. For read or write requests, the system shall require user name and password authentication and shall support SSL (Secure Socket Layer) or equivalent data encryption.
4. System shall support discovery through a Web services connection or shall provide a tool available through the Operator Interface that will reveal the path/identifier needed to allow a third party Web services device to read data from or write data to any object in the system which supports this service.

2.3 OPERATOR INTERFACE

A. The Operator Workstation or server shall conform to the BACnet Operator Workstation (B-OWS) or BACnet Advanced Workstation (B-AWS) device profile as specified in ASHRAE/ANSI 135 BACnet Annex L.

B. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information.

C. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

D. Hardware. Each workstation or web server shall consist of the following:

1. Computer. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified elsewhere in this document. The following hardware requirements also apply:

    a. The hard disk shall have sufficient memory to store:

        i. All required operator workstation software.
        ii. A DDC database at least twice the size of the delivered system database.
        iii. One year of trend data based on the points specified to be trended at their specified trend intervals.

    b. Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.
    c. Minimum hardware configuration shall include the following:

        i. Dual or Quad Core Processor
        ii. 6 GB RAM
        iii. 500 GB hard disk providing data at 3.0 Gb/sec
        iv. 16x DVD-RW drive
        v. Serial, parallel, and network communication ports and cables as required for proper DDC system operation

E. System Software.

1. Operating System. Web server or workstation shall have an industry-standard professional-grade operating system. Operating system shall meet or exceed the DDC System manufacturers minimum requirements for their software. Typically acceptable systems include Microsoft Windows7,Microsoft Vista, Microsoft Windows XP Pro, Windows Server 2003 or 2008, Red Hat Enterprise Linux, or Ubuntu Desktop 10.04.
2. System Graphics. The operator interface software shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.

    a. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.
    b. Animation. Graphics shall be able to animate by displaying different image files for changed object status.
    c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.
    d. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on

browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Adobe Flash).

3. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in the same formats as are used for system graphics.
4. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.

F. System Applications. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard IBM-compatible PCs with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.
2. Manual Controller Memory Download. Operators shall be able to download memory from the system database to each controller.
3. System Configuration. The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password protection. Operators shall be able to configure the system.
4. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
5. Security. Each operator shall be required to log on to the system with user name and password in order to view, edit, add, or delete data.

    a. Operator Access. The user name and password combination shall define accessible viewing, editing, adding, and deleting privileges for that operator. Users with system administrator rights shall be able to create new users and edit the privileges of all existing users. System Administrators shall also be able to vary and deny each operator's privileges based on the geographic location, such as the ability to edit operating parameters in Building A, to view but not edit parameters in Building B, and to not even see equipment in Building C.
    b. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. This auto logoff time shall be user adjustable.

c. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.

6. System Diagnostics. The system shall automatically monitor the operation of all building management panels and controllers. The failure of any device shall be annunciated to the operator.
7. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Section 23 09 93 (Sequences of Operation). Alarms shall be BACnet alarm objects and shall use BACnet alarm services.
8. Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying on acronyms.
9. Alarm Reactions. Operator shall be able to configure (by object) what, if any actions are to be taken during an alarm. As a minimum, the workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send page, and audibly annunciate.
10. Alarm and Event log. Operators shall be able to view all system alarms and changes of state from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and delete alarms, and archive closed alarms to the workstation or web server hard disk.
11. Trend Logs. The operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as specified in Section 23 09 93 (Sequences of Operation). Trends shall be BACnet trend objects.
12. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object or property in the system. The status shall be available by menu, on graphics, or through custom programs.
13. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.
14. Standard Reports. Furnish the following standard system reports:

    a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.
    b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.
    c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:

        i. Alarm History.
        ii. Trend Data. Operator shall be able to select trends to be logged.

iii. Operator Activity. At a minimum, system shall log operator log in and log out, control parameter changes, schedule changes, and alarm acknowledgment and deletion. System shall date and time stamp logged activity.

15. Energy Reports. System shall include an easily configured energy reporting tool that provides the capabilities described in this section.

    a. The energy reporting tool shall be accessible through the same user interface (Web browser or operator workstation software) as is used to manage the BAS.
    b. The energy reporting tool shall be preconfigured by the Contractor to gather and store energy demand and consumption data from each energy source that provides metered data to the BAS. Meter data shall be stored at 5 minute intervals unless otherwise specified in the Sequence of Operation provided in section 23 09 93. This data shall be maintained in an industry standard SQL database for a period of not less than five years.
    c. The energy reporting tool shall allow the operator to select an energy source and a time period of interest (day, week, month, year, or date range) and shall provide options to view the data in a table, line graph, bar graph, or pie chart. The tool shall also allow the operator to select two or more data sources and display a comparison of the energy used over this period in any of the listed graph formats, or to total the energy used by the selected sources and display that data in the supported formats.
    d. The energy reporting tool shall allow the operator to select and energy source and two time periods of interest (day, week, month, year, or date range) and display a graph that compares the energy use over the two time periods in any of the graph formats listed in the previous paragraph. The tool shall also allow the operator to select multiple energy sources and display a graph that compares the total energy used by these sources over the two time periods.
    e. The energy reporting tool shall allow the operator to easily generate the previously described graphs "on the fly," and shall provide an option to store the report format so the operator can select that format to regenerate the graph at a future date. The tool shall also allow the user to schedule these reports to run on a recurring basis using relative time periods, such as automatically generating a consumption report on the first Monday of each month showing consumption over the previous month. Automatically generated reports shall be archived on the server in a common industry format such as Adobe PDF or Microsoft Excel with copies e-mailed to a user editable list of recipients.
    f. The energy reporting tool shall be capable of collecting and displaying data from the following types of meters:

        i. Electricity
        ii. Gas
        iii. Oil
        iv. Steam
        v. Chilled Water

vi. Potable Water
vii. Heating and cooling degree days. (May be calculated from sensor data rather than metered.)

g. The user shall have the option of using Kw (Kwh) or Btu/hr (Btu) as the units for demand and consumption reports. Multiples of these units (MWH, kBtu, etc.) shall be used as appropriate. All selected sources shall be automatically converted to the selected units. The user shall similarly have the option of entering facility area and occupancy hours and creating reports that are normalized on an area basis, an annual use basis, or an occupied hour basis.
h. The user shall have the option of entering benchmark data for an individual facility or a group of facilities.
i. The user shall have the option of displaying any or all of the following data on any chart, line, or bar graph generated by the energy reporting tool:

i. Low/High/Average value of the metered value being displayed.
ii. Heating and/or Cooling Degree Days for the time period(s) being displayed.

16. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface.

G. Workstation Application Editors. Each PC or browser workstation shall support editing of all system applications. The applications shall be downloaded and executed at one or more of the controller panels.

1. Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and set points for all controllers.
2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and schedule type. Exception schedules and holidays shall be shown clearly on the calendar. The start and stop times for each object shall be adjustable from this interface.
3. Custom Application Programming. Provide the tools to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:

a. Language. Language shall be graphically based and shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks.
b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add,

modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.

c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.

d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step's time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.

e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.

g. Variables. Operator shall be able to use variable values in program conditional statements and mathematical functions.

i. Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.

ii. System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

H. Portable Operator's Terminal. Provide all necessary software to configure an IBM-compatible laptop computer for use as a Portable Operator's Terminal. Operator shall be able to connect configured Terminal to the system network or directly to each controller for programming, setting up, and troubleshooting.

2.4 CONTROLLER SOFTWARE

A. Furnish the following applications for building and energy management. All software application shall reside and operate in the system controllers. Applications shall be editable through operator workstation, web browser interface, or engineering workstation.

B. System Security. See Paragraph 2.3.E.5 (Security) and Paragraph 2.3.E.14.c.iii (Operator Activity).

C. Scheduling. Provide the capability to execute control functions according to a user created or edited schedule. Each schedule shall provide the following schedule options as a minimum:

1. Weekly Schedule. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).

2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule has executed, the system shall discard and replace the exception schedule with the standard schedule for that day of the week.
3. Holiday Schedules. Provide the capability for the operator to define up to 24 special or holiday schedules. These schedules will be repeated each year. The operator shall be able to define the length of each holiday period.

D. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.
E. Binary Alarms. Each binary object shall have the capability to be configured to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.
F. Analog Alarms. Each analog object shall have both high and low alarm limits. The operator shall be able to enable or disable these alarms.
G. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display on graphics.
H. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.
I. Demand Limiting.

1. The demand-limiting program shall monitor building power consumption from a building power meter (provided by others) which generates pulse signals or a BACnet communications interface. An acceptable alternative is for the system to monitor a watt transducer or current transformer attached to the building feeder lines.
2. When power consumption exceeds adjustable levels, system shall automatically adjust setpoints, de-energize low-priority equipment, and take other programmatic actions to reduce demand as specified in Section 23 09 93 (Sequences of Operation). When demand drops below adjustable levels, system shall restore loads as specified.

J. Maintenance Management. The system shall be capable of generating maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as specified in 23 09 93 (Sequences of Operation).
K. Sequencing. Application software shall sequence chillers, boilers, and pumps as specified in Section 23 09 93 (Sequences of Operation).
L. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs. The calculation interval, PID gains, and other tuning parameters shall be adjustable by a user with the correct security level.
M. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.
N. Energy Calculations.

1. The system shall accumulate and convert instantaneous power (kW) or flow rates (L/s [gpm]) to energy usage data.
2. The system shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

O. Anti-Short Cycling. All binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

P. On and Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and a setpoint. The algorithm shall be direct-acting or reverse-acting.

Q. Runtime Totalization. Provide software to totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as specified in Section 23 09 93 (Sequence of Operations).

2.5 CONTROLLERS

A. General. Provide an adequate number of Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified in Section 23 09 23 Article 1.9 (System Performance). Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L. Unless otherwise specified, hardwired actuators and sensors may be used in lieu of BACnet Smart Actuators and Smart Sensors.

B. BACnet.

1. Building Controllers (BCs). Each BC shall conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L, and shall be listed as a certified B-BC in the BACnet Testing Laboratories (BTL) Product Listing.
2. Advanced Application Controllers (AACs). Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.
3. Application Specific Controllers (ASCs). Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.
4. Smart Sensors (SSs). Each SS shall conform to BACnet Smart Sensor (B-SS) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-SS in the BACnet Testing Laboratories (BTL) Product Listing.
5. BACnet Communication.

    a. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing.
    b. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.
    c. Each AAC shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall

reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

d. Each ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
e. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
f. Each SS shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using ARCNET or MS/TP Data Link/Physical layer protocol.

C. Communication

1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.
2. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.
3. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.
4. Stand-Alone Operation. Each piece of equipment specified in Section 23 09 93 shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network such as outdoor air conditions, supply air or water temperature coming from source equipment, etc.

D. Environment. Controller hardware shall be suitable for anticipated ambient conditions.

1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).
2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

E. Keypad. Provide a local keypad and display for each BC and AAC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not normally provide a keypad and display for each BC and AAC, provide the software and any interface cabling needed to use a laptop computer as a Portable Operator's Terminal for the system.

F. Real-Time Clock. Controllers that perform scheduling shall have a real-time clock.

G. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to a field-removable modular terminal strip or to a termination card connected by a ribbon cable. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

H. Memory.

1. Controller memory shall support operating system, database, and programming requirements.
2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.
3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

I. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

J. Transformer. ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2.6 INPUT AND OUTPUT INTERFACE

A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

B. Protection. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground shall cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no controller damage.

C. Binary Inputs. Binary inputs shall allow the monitoring of ON/OFF signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall also accumulate up to 10 pulses per second.

E. Analog Inputs. Analog inputs shall monitor low-voltage (0–10 Vdc), current (4–20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs. Binary outputs shall provide for ON/OFF operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on Building Controllers shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

G. Analog Outputs. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0–10 Vdc or a 4–20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.

H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

I. System Object Capacity. The system size shall be expandable to at least twice the number of input/ output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system

2.7 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.

    a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
    b. Line voltage units shall be UL recognized and CSA listed.

B. Power Line Filtering.

1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
    a. Dielectric strength of 1000 V minimum
    b. Response time of 10 nanoseconds or less
    c. Transverse mode noise attenuation of 65 dB or greater
    d. Common mode noise attenuation of 150 dB or greater at 40–100 Hz

2.8 AUXILIARY CONTROL DEVICES

A. Motorized Control Dampers, unless otherwise specified elsewhere, shall be as follow.

1. Type. Control dampers shall be the parallel or opposed-blade type as specified below or as scheduled on drawings.

    a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.
    b. Other modulating dampers shall be opposed-blade.
    c. Two-position shutoff dampers shall be parallel- or opposed-blade with blade and side seals.

2. Frame. Damper frames shall be 2.38 mm (13 gauge) galvanized steel channel or 3.175 mm (⅛ in.) extruded aluminum with reinforced corner bracing.
3. Blades. Damper blades shall not exceed 20 cm (8 in.) in width or 125 cm (48 in.) in length. Blades shall be suitable for medium velocity (10 m/s [2000 fpm]) performance. Blades shall be not less than 1.5875 mm (16 gauge).
4. Shaft Bearings. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.
5. Seals. Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than 50 L/s·m^2(10 cfm per ft^2) at 1000 Pa (4 in. w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of 7.5 m/s (1500 fpm).

6. Sections. Individual damper sections shall not exceed 125 cm × 150 cm (48 in. × 60 in.). Each section shall have at least one damper actuator.
7. Modulating dampers shall provide a linear flow characteristic where possible.
8. Linkages. Dampers shall have exposed linkages.

B. Electric Damper and Valve Actuators.

1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
3. Signal and Range. Proportional actuators shall accept a 0–10 Vdc or a 0–20 mA control signal and shall have a 2–10 Vdc or 4–20 mA operating range. (Floating motor actuators may be substituted for proportional actuators in terminal unit applications as described in paragraph 2.6H.)
4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N·m (60 in.-lb) torque capacity shall have a manual crank.

C. Temperature Sensors.

1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m^2(10 ft^2) of duct cross-section.
3. Space Sensors. Space sensors shall have override switch and communication port only.
4. Differential Sensors. Provide matched sensors for differential temperature measurement.

D. Humidity Sensors.

1. Duct and room sensors shall have a sensing range of 20%–80%.
2. Duct sensors shall have a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20%–95% RH and shall be suitable for ambient conditions of -40°C–75°C (-40°F–170°F).
4. Humidity sensors shall not drift more than 1% of full scale annually.

E. Relays.

1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

F. Override Timers.

1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0–6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.

G. Current Transmitters.

1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4–20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
3. Unit shall be split-core type for clamp-on installation on existing wiring.

H. Current Transformers.

1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
2. Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.
3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

I. Voltage Transmitters.

1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4–20 mA output with zero and span adjustment.
2. Adjustable full-scale unit ranges shall be 100–130 Vac, 200–250 Vac, 250–330 Vac, and 400–600 Vac. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

J. Voltage Transformers.

1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
2. Transformers shall be suitable for ambient temperatures of 4°C–55°C (40°F–130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.
3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

K. Power Monitors.

1. Selectable rate pulse output for kWh reading, 4–20 mA output for kW reading, N.O. alarm contact, and ability to operate with 5.0 amp current inputs or 0–0.33 volt inputs.
2. 1.0% full-scale true RMS power accuracy, +0.5 Hz, voltage input range 120–600 V, and auto range select.

3. Under voltage/phase monitor circuitry.
4. NEMA 1 enclosure.
5. Current transformers having a 0.5% FS accuracy, 600 VAC isolation voltage with 0–0.33 V output. If 0–5 A current transformers are provided, a three-phase disconnect/shorting switch assembly is required.

L. Current Switches.

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

M. Pressure Transducers.

1. Transducers shall have linear output signal and field-adjustable zero and span.
2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.

N. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

O. Pressure-Electric (PE) Switches.

1. Shall be metal or neoprene diaphragm actuated, operating pressure rated for 0–175 kPa (0–25 psig), with calibrated scale minimum setpoint range of 14–125 kPa (2–18 psig) minimum, UL listed.
2. Provide one- or two-stage switch action (SPDT, DPST, or DPDT) as required by application Electrically rated for pilot duty service (125 VA minimum) and/or for motor control.
3. Switches shall be open type (panel-mounted) or enclosed type for remote installation. Enclosed type shall be NEMA 1 unless otherwise specified.
4. Each pneumatic signal line to PE switches shall have permanent indicating gauge.

P. Occupancy Sensors. Occupancy sensors shall utilize Passive Infrared (PIR) and/or Microphonic Passive technology to detect the presence of people within a room. Sensors shall be mounted as indicated on the approved drawings. The sensor output shall be accessible by any lighting and/or HVAC controller in the system. Occupancy sensors shall be capable of being powered from the lighting or HVAC control panel, as shown on the drawings. Occupancy sensor delay shall be software adjustable through the user interface and shall not require manual adjustment at the sensor.

Q. Local Control Panels.

1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.
2. Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually

identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

3. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

2.9 WIRING AND RACEWAYS

A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

2.10 FIBER OPTIC CABLE SYSTEM

A. Optical Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm.

B. Connectors. Field terminate optical fibers with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

PART 3 – EXECUTION

3.1 EXAMINATION

A. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

B. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by—and at the expense of—this contractor.

3.2 PROTECTION

A. The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.

B. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION

A. Site

1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.
2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Submittals. See Section 23 09 23 Article 1.10 (Submittals).

C. Test and Balance.

1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
2. The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.
3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.

D. Life Safety.

1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as specified in Section 23 09 93 (Sequences of Operation).
2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as specified in Section 23 09 93 (Sequences of Operation).
3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 28.

E. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:

1. All communication media and equipment shall be provided as specified in Section 23 09 23 Article 2.2 (Communication).
2. Each supplier of a controls product is responsible for the configuration, programming, start up, and testing of that product to meet the sequences of operation described in Section 23 09 93.
3. The contractor shall coordinate and resolve any incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.

4. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
5. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
C. Install equipment in readily accessible locations as defined by Chapter 1 Article 100 Part A of the National Electrical Code (NEC).
D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
E. All equipment, installation, and wiring shall comply with industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.5 FIELD QUALITY CONTROL

A. All work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 09 23 Article 1.8 (Codes and Standards).
B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.
C. Contractor shall have work inspection by local and/or state authorities having jurisdiction over the work.

3.6 WIRING

A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification, Where the requirements of this section differ from Division 26, the requirements of this section shall take precedence.
B. All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements.
C. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.
D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for the intended application.
E. All wiring in mechanical, electrical, or service rooms – or where subject to mechanical damage – shall be installed in raceway at levels below 3 m (10ft).
F. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).
G. Do not install wiring in raceway containing tubing.
H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.

I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.
J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.
M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
O. Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer’s recommendations and NEC requirements, except as noted elsewhere.
P. Include one pull string in each raceway 2.5 cm (1 in.) or larger.
Q. Use color-coded conductors throughout with conductors of different colors.
R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
S. Conceal all raceways except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g. steam pipes or flues).
T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
U. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.
V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.
W. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
X. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.
Y. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

3.7 COMMUNICATION WIRING

A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification.
B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling
C. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.

D. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
E. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
F. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lighting arrestor shall be installed according to manufacturer’s instructions.
G. All runs of communication wiring shall be unspliced length when that length is commercially available.
H. All communication wiring shall be labeled to indicate origination and destination data.
I. All communication wiring shall be labeled to indicate origination and destination data.
J. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."
K. BACnet MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135. This includes but is not limited to:

    1. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 120 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot.)
    2. The maximum length of an MS/TP segment is 1200 meters (4000 ft) with AWG 18 cable. The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485.
    3. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.
    4. An MS/TP EIA-485 network shall have no T connections.

3.8 FIBER OPTIC CABLE

A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.
B. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

3.9 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer's recommendations.
B. Mount sensors rigidly and adequately for environment within which the sensor operates.
C. Room temperature sensors shall be installed on concealed junction boxes properly supported by wall framing.
D. All wires attached to sensors shall be sealed in their raceways or in the wall to stop air transmitted from other areas from affecting sensor readings.
E. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.
F. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m^2(1 ft^2) of coil area.
G. Do not install temperature sensors within the vapor plume of a humidifier. If installing a sensor downstream of a humidifier, install it at least 3 m (10 ft) downstream.

H. All pipe-mounted temperature sensors shall be installed in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.
I. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.
J. Differential Air Static Pressure.

1. Supply Duct Static Pressure. Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.
2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.
3. Building Static Pressure. Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.
4. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
5. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.
6. All air differential pressure sensors shall have gauge tees mounted adjacent to the taps.

K. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.10 ACTUATORS

A. General. Mount and link control damper actuators according to manufacturer's instructions.

1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
3. Provide all mounting hardware and linkages for actuator installation.

B. Electric/Electronic

1. Dampers: Actuators shall be direct mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° travel available for tightening the damper seal. Actuators shall be mounted following manufacturer’s recommendations.

3.11 WARNING LABELS

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the control system.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows.

C A U T I O N
This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to"Off"position before servicing.

B. Permanent warning labels shall be affixed to all motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows.

C A U T I O N
This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.12 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with control system address or termination number.
B. All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.
C. Permanently label or code each point of field terminal strips to show the instrument or item served.
D. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
E. Identify all other control components with permanent labels. All plug-in components shall be labeled such that label removal of the component does not remove the label.
F. Identify room sensors related to terminal boxes or valves with nameplates.
G. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.
H. Identifiers shall match record documents.

3.13 CONTROLLERS

A. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.
B. Building Controllers and Custom Application Controllers shall be selected to provide the required I/O point capacity required to monitor all of the hardware points listed in Section 23 09 93 (Sequences of Operation).

3.14 PROGRAMMING

A. Provide sufficient internal memory for the specified sequences of operation and trend logging.
B. Point Naming. Name points as shown on the equipment points list provided with each sequence of operation. See Section 23 09 93 (Sequences of Operation). If character limitations or space restrictions make it advisable to shorten the name, the abbreviations given in Appendix B to Section 23 09 93 may be used. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.
C. Software Programming.

    1. Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the contractor. Embed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:

        a. Text-based:
            i. Must provide actions for all possible situations
            ii. Must be modular and structured
            iii. Must be commented
        b. Graphic-based:
            i. Must provide actions for all possible situations
            ii. Must be documented
        c. Parameter-based:
            i. Must provide actions for all possible situations
            ii. Must be documented.

D. Operator Interface.

    1. Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as setpoints. As a minimum, show on each equipment graphic the input and output points and relevant calculated points as indicated on the applicable Points List in Section 23 09 93.
    2. The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

3.15 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing

shall be completed before the owner's representative is notified of the system demonstration.

1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.
2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers' recommendations.
4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.
5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.
6. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops.
7. Alarms and Interlocks:

    a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.
    b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.
    c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action

3.16 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration.

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.
2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the "Control System Checkout and Testing" article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.
3. The demonstration process shall follow that approved in Part 1, "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
4. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and

sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.

5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
6. Demonstrate compliance with Part 1, "System Performance."
7. Demonstrate compliance with sequences of operation through all modes of operation.
8. Demonstrate complete operation of operator interface.
9. Additionally, the following items shall be demonstrated:

    a. DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.
    b. Demand limiting. The contractor shall supply a trend data output showing the action of the demand limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.
    c. Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of-value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.
    d. Interface to the building fire alarm system.
    e. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

10. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance.

1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.

2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1, "Submittals."

3.17 CLEANING

A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.18 TRAINING

A. Provide training for a designated staff of Owner’s representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.
B. Training shall enable students to accomplish the following objectives.

1. Day-to-day Operators:

    a. Proficiently operate the system
    b. Understand control system architecture and configuration
    c. Understand DDC system components
    d. Understand system operation, including DDC system control and optimizing routines (algorithms)
    e. Operate the workstation and peripherals
    f. Log on and off the system
    g. Access graphics, point reports, and logs
    h. Adjust and change system set points, time schedules, and holiday schedules
    i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
    j. Understand system drawings and Operation and Maintenance manual
    k. Understand the job layout and location of control components
    l. Access data from DDC controllers and ASCs
    m. Operate portable operator's terminals

2. Advanced Operators:

    a. Make and change graphics on the workstation
    b. Create, delete, and modify alarms, including annunciation and routing of these
    c. Create, delete, and modify point trend logs and graph or print these both on an ad-hoc basis and at user-definable time intervals
    d. Create, delete, and modify reports
    e. Add, remove, and modify system's physical points
    f. Create, modify, and delete programming
    g. Add panels when required

h. Add operator interface stations
i. Create, delete, and modify system displays, both graphical and others
j. Perform DDC system field checkout procedures
k. Perform DDC controller unit operation and maintenance procedures
l. Perform workstation and peripheral operation and maintenance procedures
m. Perform DDC system diagnostic procedures
n. Configure hardware including PC boards, switches, communication, and I/O points
o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware
p. Adjust, calibrate, and replace system components

3. System Managers/Administrators:

a. Maintain software and prepare backups
b. Interface with job-specific, third-party operator software
c. Add new users and understand password security procedures

C. Organize the training into sessions or modules for the three levels of operators listed above. (Day-to-Day Operators, Advanced Operators, System Managers and Administrators). Students will receive one or more of the training packages, depending on knowledge level required.
D. Provide course outline and materials according to the "Submittals" article in Part 1 of this specification. Provide one copy of training material per student.
E. The instructor(s) shall be factory-trained and experienced in presenting this material.
F. Classroom training shall be done using a network of working controllers representative of installed hardware.

3.19 SEQUENCES OF OPERATION

Modular Heat Pump Air Cooled Chiller Heater (typical of 6 modules)

Chiller - Run Conditions:
The chiller shall be enabled to run whenever:

1. A definable number of chilled water coils need cooling

2. AND the outside air temperature is greater than 54°F (adj.).

Heating System Run Conditions:
The heating system shall be enabled to run whenever:

1. A definable number of hot water coils need heating.

2. AND outside air temperature is less than 65°F (adj.).

HP Chiller manufacturer provided control panel shall operate chiller modules including staging of modules, heating only, cooling only and simultaneous heating & cooling modes of operation.

The HP chiller shall run subject to its own internal safeties and controls.

Chilled Water Pump Lead/Standby Operation (Heating Water Pumps Same):
The two chilled water pumps shall run anytime the chiller is called to run. The chilled water pump shall also run for freeze protection whenever the outside air temperature is less than a user definable setpoint (adj.).

The lead pump shall start prior to the chiller being enabled and shall stop only after the chiller is disabled. The pump(s) shall therefore have:

1. A user adjustable delay on start.
2. AND a user adjustable delay on stop.

The delay times shall be set appropriately to allow for orderly chilled water system start-up, shutdown and sequencing.

The two pumps shall operate in a lead/standby fashion.

1. The lead pump shall run first.
2. On failure of the lead pump, the standby pump shall run and the lead pump shall turn off.

The designated lead pump shall rotate upon one of the following conditions (user selectable):

1. Manually through a software switch
2. If pump runtime (adj.) is exceeded
3. Daily
4. Weekly
5. Monthly

Alarms shall be provided as follows:

1. Chilled Water Pump 1
    a. Failure: Commanded on, but the status is off.
    b. Running in Hand: Commanded off, but the status is on.
    c. Runtime Exceeded: Status runtime exceeds a user definable limit.
    d. VFD Fault.

2. Chilled Water Pump 2
    a. Failure: Commanded on, but the status is off.
    b. Running in Hand: Commanded off, but the status is on.
    c. Runtime Exceeded: Status runtime exceeds a user definable limit.
    d. VFD Fault.
3. Heating Water Pump 1
    a. Failure: Commanded on, but the status is off.
    b. Running in Hand: Commanded off, but the status is on.
    c. Runtime Exceeded: Status runtime exceeds a user definable limit.
    d. VFD Fault.
4. Heating Water Pump 2
    a. Failure: Commanded on, but the status is off.
    b. Running in Hand: Commanded off, but the status is on.
    c. Runtime Exceeded: Status runtime exceeds a user definable limit.
    d. VFD Fault.

Chilled Water Differential Pressure Control (Heating Water Same):
The controller shall measure chilled water differential pressure and modulate the lead chilled water pump VFD to maintain its chilled water differential pressure setpoint. The following setpoints are recommended values. All setpoints shall be field adjusted during the commissioning period to meet the requirements of actual field conditions.

The controller shall modulate chilled water pump speed to maintain a chilled water differential pressure of 12lbf/in2 (adj.). The VFD minimum speed shall not drop below 10% (adj.).

Alarms shall be provided as follows:

1. High Chilled Water Differential Pressure: If the chilled water differential pressure is 25% (adj.) greater than setpoint.
2. Low Chilled Water Differential Pressure: If the chilled water differential pressure is 25% (adj.) less than setpoint.

Chilled Water Bypass Valve - Minimum Flow Control (Heating Water Same):
The controller shall measure chilled water flow through the chiller and, as the chilled water flow drops below setpoint, the controller shall modulate the chilled water bypass valve open to maintain the minimum chilled water flow setpoint.

Alarms shall be provided as follows:

1. Low Chilled Water Flow: If the chilled water flow is 25% (adj.) less than setpoint.

Chiller:
The chiller shall be enabled a user adjustable time after pump statuses are proven on. The chiller shall therefore have a user adjustable delay on start.

The delay time shall be set appropriately to allow for orderly chilled water system start-up, shutdown and sequencing.

The chiller shall run subject to its own internal safeties and controls.

Alarms shall be provided as follows:

1. Chiller Failure: Commanded on, but the status is off.
2. Chiller Running in Hand: Commanded off, but the status is on.
3. Chiller Runtime Exceeded: Status runtime exceeds a user definable limit.

Chilled Water Supply Temperature - Setpoint Reset:
The chilled water supply temperature setpoint shall reset using a trim and respond algorithm based on cooling requirements.

The chilled water supply temperature setpoint shall reset to a lower value as the facility's chilled water valves open beyond a user definable threshold (90% open, typ.). Once the chilled water coils are satisfied (valves closing) then the chilled water supply temperature setpoint shall gradually rise over time to reduce cooling energy use.

Chilled Water Temperature Monitoring:
The following temperatures shall be monitored:

1. Chilled water supply.
2. Chilled water return.

Alarms shall be provided as follows:

1. High Chilled Water Supply Temp: If the chilled water supply temperature is greater than 55°F (adj.).

2. Low Chilled Water Supply Temp: If the chilled water supply temperature is less than 38°F (adj.).

Hot Water Supply Temperature Setpoint Reset:
The hot water supply temperature setpoint shall reset using a trim and respond algorithm based on heating requirements.

As the facility's hot water valves open beyond a user definable threshold (90% open, typ.), the setpoint shall reset to a higher value (adj.). Once the hot water coils are satisfied (valves closing) then the setpoint shall gradually lower over time to reduce heating energy use.

Primary Hot Water Temperature Monitoring:
The following temperatures shall be monitored:

1. Primary hot water supply.
2. Primary hot water return.

Alarms shall be provided as follows:

1. High Primary Hot Water Supply Temp: If greater than 200°F (adj.).
2. Low Primary Hot Water Supply Temp: If less than 100°F (adj.).

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Chilled Water Differential Pressure	x								x		x
Chilled Water Flow	x								x		x
Chilled Water Return Temp	x								x		x
Chilled Water Supply Temp	x								x		x
Chilled Water Bypass Valve		x							x		x
Chilled Water Pump 1 VFD Speed		x							x		x
Chilled Water Pump 2 VFD Speed		x							x		x
Chilled Water Supply Temp Setpoint Reset		x							x		x
Chilled Water Pump 1 Status			x						x		x
Chilled Water Pump 1 VFD Fault			x							x	x
Chilled Water Pump 2 Status			x						x		x
Chilled Water Pump 2 VFD Fault			x							x	x
Chiller Status			x						x		x
Chilled Water Pump 1 Start/Stop				x					x		x

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Chilled Water Pump 2 Start/Stop				x					x		x
Chiller Enable				x							x
Chilled Water Differential Pressure Setpoint					x				x		x
Chilled Water Flow Setpoint					x				x		x
Outside Air Temp					x						x
Chilled Water Pump 1 Failure										x	
Chilled Water Pump 1 Running in Hand										x	
Chilled Water Pump 1 Runtime Exceeded										x	
Chilled Water Pump 2 Failure										x	
Chilled Water Pump 2 Running in Hand										x	
Chilled Water Pump 2 Runtime Exceeded										x	
Chiller Failure										x	
Chiller Running in Hand										x	
Chiller Runtime Exceeded										x	
High Chilled Water Differential Pressure										x	
High Chilled Water Supply Temp										x	
Low Chilled Water Differential Pressure										x	
Low Chilled Water Flow										x	
Low Chilled Water Supply Temp										x	
Totals	**4**	**4**	**5**	**3**	**3**	**0**	**0**	**0**	**15**	**16**	**19**

Total Hardware (16) **Total Software (34)**

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Hot Water Differential Pressure	x								x		x
Primary Hot Water Return Temp	x								x		x
Primary Hot Water Supply Temp	x								x		x
HP Chiller Hot Water Supply Temp Setpoint Reset		x							x		x
Hot Water Pump 1 VFD Speed		x							x		x
Hot Water Pump 2 VFD Speed		x							x		x

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
HP Chiller Alarm Status			x						x	x	x
HP Chiller Status			x						x		x
Hot Water Pump 1 Status			x						x		x
Hot Water Pump 1 VFD Fault			x							x	x
Hot Water Pump 2 Status			x						x		x
Hot Water Pump 2 VFD Fault			x							x	x
Low Water Level			x						x	x	x
HP Chiller Heating Enable				x							x
Hot Water Pump 1 Start/Stop				x							x
Hot Water Pump 2 Start/Stop				x							x
Hot Water Differential Pressure Set-point					x						x
Outside Air Temp					x						x
HP Chiller Failure										x	
HP Chiller Running in Hand										x	
HP Chiller Runtime Exceeded										x	
High Hot Water Differential Pressure										x	
High Primary Hot Water Supply Temp										x	
Hot Water Pump 1 Failure										x	
Hot Water Pump 1 Running in Hand										x	
Hot Water Pump 1 Runtime Ex-ceeded										x	
Hot Water Pump 2 Failure										x	
Hot Water Pump 2 Running in Hand										x	
Hot Water Pump 2 Runtime Ex-ceeded										x	
Low Hot Water Differential Pressure										x	
Low Primary Hot Water Supply Temp										x	
Totals	**3**	**3**	**7**	**3**	**2**	**0**	**0**	**0**	**11**	**17**	**18**

Total Hardware (16) **Total Software (30)**

B. Multi-Zone Variable Air Volume Air Handler (AH-1,2,3,4)

Run Conditions - Scheduled:
The unit shall run based upon an operator adjustable schedule.

Freeze Protection:
The unit shall shut down and generate an alarm upon receiving a freezestat status.

High Static Shutdown:
The unit shall shut down and generate an alarm upon receiving an high static shutdown signal.

Supply Air Smoke Detection:
The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.

Supply Fan:
The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.

Alarms shall be provided as follows:

- Supply Fan Failure: Commanded on, but the status is off.
- Supply Fan in Hand: Commanded off, but the status is on.
- Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

Supply Air Duct Static Pressure Control:
The controller shall measure duct static pressure and modulate the supply fan VFD speed to maintain a duct static pressure setpoint. The speed shall not drop below 30% (adj.). The static pressure setpoint shall be reset based upon the position of the zone dampers, with a goal of reducing the static pressure until at least one zone damper is nearly wide open.

- The initial duct static pressure setpoint shall be 1.5in H2O (adj.).
- If no zone damper is nearly wide open, the setpoint shall incrementally reset down to a minimum of 1.0in H2O (adj.) .

- As one or more dampers nears the wide open position, the setpoint shall incrementally reset up to a maximum of 2.5in H2O (adj.).

Alarms shall be provided as follows:

- High Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) greater than setpoint.
- Low Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) less than setpoint.
- Supply Fan VFD Fault.

Return Fan:
The return fan shall run whenever the supply fan runs.

Alarms shall be provided as follows:

- Return Fan Failure: Commanded on, but the status is off.
- Return Fan in Hand: Commanded off, but the status is on.
- Return Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
- Return Fan VFD Fault.

Return Airflow:
The return fan VFD shall modulate in unison with the supply fan VFD. Return airflow setpoint shall be 100% (adj.) of the supply airflow minus 500ft3/min (adj.). The return fan VFD speed shall not drop below 20% (adj.).

Alarms shall be provided as follows:

- High Return Airflow: If the return airflow is an adjustable percentage greater than setpoint.
- Low Return Airflow: If the return airflow is an adjustable percentage less than setpoint.

Supply Air Temperature Setpoint - Optimized:
The controller shall monitor the supply air temperature and shall maintain a supply air temperature setpoint reset based on zone cooling requirements.

The supply air temperature setpoint shall be reset based on zone cooling requirements as follows:

- The initial supply air temperature setpoint shall be 55°F (adj.).
- As cooling demand increases, the setpoint shall incrementally reset down to a minimum of 53°F (adj.).
- As cooling demand decreases, the setpoint shall incrementally reset up to a maximum of 72°F (adj.) .

Cooling Coil Valve:
The controller shall measure the supply air temperature and modulate the cooling coil valve to maintain its cooling setpoint.

The cooling shall be enabled whenever:

- Outside air temperature is greater than 60°F (adj.).
- AND the economizer (if present) is disabled or fully open.
- AND the supply fan status is on.
- AND the heating (if present) is not active.

The cooling coil valve shall open to 50% (adj.) whenever the freezestat (if present) is on.

Alarms shall be provided as follows:

- High Supply Air Temp: If the supply air temperature is 5°F (adj.) greater than setpoint.

Low Supply Air Temperature Alarm:
The controller shall alarm if the supply air temperature is less than 50°F (adj.).

Economizer:
The controller shall measure the mixed air temperature and modulate the economizer dampers in sequence to maintain a setpoint 2°F (adj.) less than the supply air temperature setpoint. The outside air dampers shall maintain a minimum adjustable position of 20% (adj.) open whenever occupied.

The economizer shall be enabled whenever:

- Outside air temperature is less than 70°F (adj.).
- AND the outside air temperature is less than the return air temperature.
- AND the supply fan status is on.

The economizer shall close whenever:

- Mixed air temperature drops from 45°F to 40°F (adj.).
- OR the freezestat (if present) is on.
- OR on loss of supply fan status.

The outside and exhaust air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.

Minimum Outside Air Ventilation - Carbon Dioxide (CO2) Control:
When in the occupied mode, the controller shall monitor zone CO2 concentrations served by this air handling unit. The controller shall take the highest zone CO2 concentration and modulate the outside air dampers open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of 750 ppm (adj.).

Alarms shall be provided as follows:

- High Zone Carbon Dioxide Concentration: If the highest zone CO2 concentration is greater than 1000 ppm (adj.).

Prefilter Differential Pressure Monitor:
The controller shall monitor the differential pressure across the prefilter.

Alarms shall be provided as follows:

- Prefilter Change Required: Prefilter differential pressure exceeds a user definable limit (adj.).

Mixed Air Temperature:
The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present).

Alarms shall be provided as follows:

- High Mixed Air Temp: If the mixed air temperature is greater than 90°F (adj.).
- Low Mixed Air Temp: If the mixed air temperature is less than 45°F (adj.).

Return Air Temperature:
The controller shall monitor the return air temperature and use as required for setpoint control or economizer control (if present).

Alarms shall be provided as follows:

- High Return Air Temp: If the return air temperature is greater than 90°F (adj.).
- Low Return Air Temp: If the return air temperature is less than 45°F (adj.).

Supply Air Temperature:
The controller shall monitor the supply air temperature.

Alarms shall be provided as follows:

- High Supply Air Temp: If the supply air temperature is greater than 85°F (adj.).
- Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.).

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Mixed Air Temp	x								x		x
Prefilter Differential Pressure	x								x		
Return Air Temp	x								x		x
Return Airflow	x								x		x
Supply Air Static Pressure	x								x	x	x
Supply Air Temp	x								x		x
Supply Airflow	x								x		x
Cooling Valve		x							x		x
Mixed Air Dampers		x							x		x
Return Fan VFD Speed		x							x		x
Supply Fan VFD Speed		x							x		x
Freezestat			x						x	x	x
High Static Shutdown			x						x	x	x
Return Fan Status			x						x		x
Return Fan VFD Fault			x							x	
Supply Air Smoke Detector			x						x	x	x
Supply Fan Status			x						x		x
Supply Fan VFD Fault			x							x	x
Return Fan Start/Stop				x					x		x
Supply Fan Start/Stop				x					x		x
Economizer Mixed Air Temp Set-point					x				x		x
Return Airflow Setpoint					x				x		x
Supply Air Static Pressure Setpoint					x				x		x
Supply Air Temp Setpoint					x				x		x
Zone Carbon Dioxide PPM					x				x		x
Zone Carbon Dioxide PPM Setpoint					x				x		x
Schedule								x			
High Mixed Air Temp										x	
High Return Air Temp										x	
High Return Airflow										x	
High Supply Air Static Pressure										x	
High Supply Air Temp										x	
High Supply Air Temp										x	
High Zone Carbon Dioxide Concen-tration										x	

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Low Mixed Air Temp										x	
Low Return Air Temp										x	
Low Return Airflow										x	
Low Supply Air Static Pressure										x	
Low Supply Air Temp										x	
Low Supply Air Temp										x	
Prefilter Change Required										x	x
Return Fan Failure										x	
Return Fan in Hand										x	
Return Fan Runtime Exceeded										x	
Supply Fan Failure										x	
Supply Fan in Hand										x	
Supply Fan Runtime Exceeded										x	
Totals	**7**	**4**	**7**	**2**	**6**	**0**	**0**	**1**	**24**	**26**	**25**

Total Hardware (20) **Total Software (57)**

C. 100% Outside Air Variable Air Volume Air Handler (AH-5,6)

Run Conditions - Requested:
The unit shall run whenever any room static pressure sensor returns negative(-) 0.08in H20 (adj.) or lower.

Air Handler Lead/Standby Operation:
The two air handlers shall operate in a lead/standby fashion.

1. The lead air handler shall run first.
2. On failure of the lead air handler, the standby air handler shall run and the lead air handler shall turn off.

The designated lead air handler shall rotate upon one of the following conditions (user selectable):

1. Manually through a software switch
2. If air handler runtime (adj.) is exceeded
3. Daily
4. Weekly

5. Monthly

Freeze Protection:
The unit shall shut down and generate an alarm upon receiving a freezestat status.

High Static Shutdown:
The unit shall shut down and generate an alarm upon receiving a high static shutdown signal.

Supply Air Smoke Detection:
The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.

Outside Air Damper:
The outside air damper shall open anytime the unit runs and shall close anytime the unit stops. The supply fan shall start only after the damper status has proven the damper is open. The outside air damper shall close 4sec (adj.) after the supply fan stops.

Alarms shall be provided as follows:

- Outside Air Damper Failure: Commanded open, but the status is closed.
- Outside Air Damper in Hand: Commanded closed, but the status is open.

Supply Fan:
The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.

Alarms shall be provided as follows:

- Supply Fan Failure: Commanded on, but the status is off.
- Supply Fan in Hand: Commanded off, but the status is on.
- Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

Room Static Pressure Control:
The controller shall measure room static pressure and shall modulate the supply fan VFD

speed to maintain a minimum room static pressure setpoint of negative(-) 0.05in H2O (adj.) in all rooms. The supply fan VFD speed shall not drop below 30% (adj.).

Alarms shall be provided as follows:

- High Room Static Pressure: If a room static pressure is 25% (adj.) greater than setpoint.
- Low Room Static Pressure: If a room static pressure is 25% (adj.) less than setpoint.
- Supply Fan VFD Fault.

Supply Air Temperature Setpoint - Fixed:
The controller shall monitor the supply air temperature and shall maintain fixed supply air temperature setpoints as follows:

- Cooling: The setpoint shall be 70°F (adj.).
- Heating: The setpoint shall be 75°F (adj.).

Cooling Coil Valve:
The controller shall measure the supply air temperature and modulate the cooling coil valve to maintain its cooling setpoint.

The cooling shall be enabled whenever:

- Outside air temperature is greater than 75°F (adj.).
- AND the outside air damper is open.
- AND the supply fan status is on.
- AND the heating (if present) is not active.

The cooling coil valve shall open to 50% (adj.) whenever the freezestat (if present) is on.

Alarms shall be provided as follows:

- High Supply Air Temp: If the supply air temperature is 5°F (adj.) greater than setpoint.

Heating Coil Valve:
The controller shall measure the supply air temperature and modulate the heating coil valve to maintain its heating setpoint.

The heating shall be enabled whenever:

- Outside air temperature is less than 70°F (adj.).
- AND the supply fan status is on.
- AND the cooling (if present) is not active.

The heating coil valve shall open whenever:

- Supply air temperature drops from 40°F to 35°F (adj.).
- OR the freezestat (if present) is on.

Alarms shall be provided as follows:

- Low Supply Air Temp: If the supply air temperature is 5°F (adj.) less than setpoint.

Prefilter Differential Pressure Monitor:
The controller shall monitor the differential pressure across the prefilter.

Alarms shall be provided as follows:

- Prefilter Change Required: Prefilter differential pressure exceeds a user definable limit (adj.).

Supply Air Temperature:
The controller shall monitor the supply air temperature.

Alarms shall be provided as follows:

- High Supply Air Temp: If the supply air temperature is greater than 80°F (adj.).
- Low Supply Air Temp: If the supply air temperature is less than 65°F (adj.).

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Prefilter Differential Pressure	x								x		
Room Static Pressure	x								x	x	x
Supply Air Temp	x								x		x
Cooling Valve		x							x		x
Heating Valve		x							x		x
Supply Fan VFD Speed		x							x		x
Freezestat			x						x	x	x
Outside Air Damper Status			x						x		x
Supply Air Smoke Detector			x						x	x	x
Supply Fan Status			x						x		x
Supply Fan VFD Fault			x							x	x
Outside Air Damper				x							x
Supply Fan Start/Stop				x					x		x
Room Static Pressure Setpoint					x				x		x
Supply Air Temp Setpoint					x				x		x
Low Room Static Pressure										x	
High Supply Air Temp										x	
Low Supply Air Temp										x	
Outside Air Damper Failure										x	
Outside Air Damper in Hand										x	
Prefilter Change Required										x	x
Supply Fan Failure										x	
Supply Fan in Hand										x	
Supply Fan Runtime Exceeded										x	
Totals	**3**	**3**	**5**	**2**	**2**	**0**	**0**	**0**	**13**	**13**	**15**

Total Hardware (13) **Total Software (28)**

D. Variable Air Volume Box

Run Conditions - Scheduled:
The unit shall run according to a user definable time schedule in the following modes:

- Occupied Mode: The unit shall maintain
  - A 75°F (adj.) cooling setpoint

        - A 70°F (adj.) heating setpoint.

- Unoccupied Mode (night setback): The unit shall maintain
    - A 85°F (adj.) cooling setpoint.
    - A 55°F (adj.) heating setpoint.

Alarms shall be provided as follows:

- High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
- Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

Minimum Ventilation on Carbon Dioxide (CO2) Concentration:
When in the occupied mode, the controller shall measure the zone CO2 concentration and modulate the zone damper open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of not more than 750 ppm (adj.).

Alarms shall be provided as follows:

- High Zone Carbon Dioxide Concentration: If the zone CO2 concentration is greater than 1000 ppm (adj.).

Zone Setpoint Adjust:
The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

Zone Optimal Start:
The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

Zone Unoccupied Override:
A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

Variable Volume Terminal Unit - Flow Control:
The unit shall maintain zone setpoints by controlling the airflow through one of the following:

Occupied:

- When zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.
- When the zone temperature is less than the cooling setpoint, the zone damper shall maintain the minimum required zone ventilation (adj.).

Unoccupied:

- When the zone is unoccupied the zone damper shall control to its minimum unoccupied airflow (adj.).
- When the zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum unoccupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.

Reheating Coil Valve:
The controller shall measure the zone temperature and modulate the reheating coil valve open on dropping temperature to maintain its heating setpoint.

When cold air is available from the AHU and there is no fan present in the box, the zone damper shall modulate to the minimum occupied airflow (adj.). If more heat is required, the zone damper shall modulate to the auxiliary heating airflow (adj.).

Environmental Index:
When the zone is occupied, the controller will monitor the deviation of the zone temperature from the heating or cooling setpoint. The controller will also monitor the carbon dioxide concentration and compare it to comfort conditions. This data will be used to calculate a 0 - 100% Environmental Index which gives an indication of how well the zone is maintaining comfort. The controller will also calculate the percentage of time since occupancy began that the Environmental Index is 70% or higher. Optionally, a weighting factor can be configured to adjust the contribution of the zone to the rollup average index based upon the floor area of the zone, importance of the zone, or other static criteria.

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Airflow	x								x		x
Zone Carbon Dioxide PPM	x								x		x
Zone Setpoint Adjust	x										x
Zone Temp	x								x		x
Reheating Valve		x							x		x
Zone Damper		x							x		x
Zone Override			x						x		x
Airflow Setpoint					x				x		x
Cooling Setpoint					x				x		x
Environmental Index					x				x		
Heating Setpoint					x				x		x
Percent of Time Satisfied					x				x		
Zone Carbon Dioxide PPM Setpoint					x				x		x
Schedule								x			
High Zone Carbon Dioxide Concentration										x	
High Zone Temp										x	
Low Zone Temp										x	
Totals	**4**	**2**	**1**	**0**	**6**	**0**	**0**	**1**	**12**	**3**	**11**
Total Hardware (7)					**Total Software (22)**						

E. Kitchen Exhaust System Monitoring (KEF-1,2,3,4,5,6,7)(KH-1,2,3,4,5F,5B,6F,6B,7)

The type 1 commercial kitchen hoods and associated kitchen exhaust fans shall be controlled by the manufacturer provided control panels.

The building EMS system shall monitor the following points:

- Room Temperature
- Fan Status
- Building Pressures
- Prep Time Button
- Fans Button
- Lights Button
- Wash Button

Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan in Hand: Commanded off, but the status is on.
- Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Room Temperature	x								x		x
Building Pressure	x								x		x
Fan Status			x						x		x
Prep Time Button			x						x		x
Fans Button			x						x		x
Lights Button			x						x		x
Wash Button			x						x		x
Fan Failure										x	
Fan in Hand										x	
Fan Runtime Exceeded										x	
Totals	**2**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**7**	**3**	**7**

Total Hardware (7) **Total Software (10)**

F. Kitchen Exhaust System Monitoring (KEF-8)(KH-8)

The fan KEF-8 shall be interlocked to run whenever the dishwasher runs unless shut down on safeties. The fan shall continue to run for 5 minutes (adj.) after dishwasher turns off.

Fan:
The fan shall have a user definable (adj.) minimum runtime.

Fan Status:
The controller shall monitor the fan status.

Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan in Hand: Commanded off, but the status is on.
- Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Dishwasher Status			x						x		x
Fan Status			x						x		x
Fan Start/Stop				x					x		x
Fan Failure										x	
Fan in Hand										x	
Fan Runtime Exceeded										x	
Totals	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**3**	**3**

Total Hardware (3) **Total Software (6)**

G. General Exhaust Fans (EF-9,10,11,12,13,14)

Run Conditions - Interlocked:
The fan EF-9 shall be interlocked to run whenever Air Handling Unit AH-1 runs unless shutdown on safeties.

The fan EF-10 shall be interlocked to run whenever Air Handling Unit AH-1 runs unless shutdown on safeties.

The fan EF-11 shall be interlocked to run whenever Air Handling Unit AH-3 runs unless shutdown on safeties.

The fan EF-12 shall be interlocked to run whenever Air Handling Unit AH-2 runs unless shutdown on safeties.

The fan EF-13 shall be interlocked to run whenever Air Handling Unit AH-4 runs unless shutdown on safeties.

The fan EF-14 shall be interlocked to run whenever Air Handling Unit AH-4 runs unless shutdown on safeties.

Fan:
The fan shall have a user definable (adj.) minimum runtime.

Fan Status:
The controller shall monitor the fan status.

Alarms shall be provided as follows:

- Fan Failure: Commanded on, but the status is off.
- Fan in Hand: Commanded off, but the status is on.
- Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Fan Status			x						x		x
Fan Start/Stop				x					x		x
Fan Failure										x	
Fan in Hand										x	
Fan Runtime Exceeded										x	
Totals	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**2**	**3**	**2**

Total Hardware (2) **Total Software (5)**

H. IT Room Ductless Split System

The unit shall operate through manufacturer's thermostat and controls. Building EMS to monitor space temperature and unit status.
Run Conditions – Scheduled:
The unit shall run according to a user definable time schedule in the following modes:

- Occupied Mode: The unit shall maintain
  - A 75°F (adj.) cooling setpoint
  - A 70°F (adj.) heating setpoint

Alarms shall be provided as follows:

- High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).
- Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

Split System Lead/Standby Operation:
The two split systems shall operate in a lead/standby fashion.

1. The lead split system shall run first.
2. On failure of the lead split system, the standby split system shall run and the lead split system shall turn off.

The designated lead split system shall rotate upon one of the following conditions (user selectable):

6. Manually through a software switch
7. If air handler runtime (adj.) is exceeded
8. Daily
9. Weekly
10. Monthly

Zone Setpoint Adjust:
The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

Zone Optimal Start:
The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

Zone Unoccupied Override:
A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

Fan:
The fan shall run anytime the unit is commanded to run, unless shutdown on safeties.

Heating and Cooling:
The manufacturer’s controller shall operate to maintain room temperature setpoint.

Fan Status:
The Building EMS shall monitor the fan status.

Alarms to be provided as follows:

- Fan Failure: Commanded on, but the status is off.

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Zone Setpoint Adjust	x										x
Zone Temp	x								x		x
Fan Status			x						x		x
Zone Override			x						x		x
Fan Start/Stop				x					x		x
Cooling Setpoint					x				x		x
Heating Setpoint					x				x		x
Schedule								x			
Fan Failure										x	
High Zone Temp										x	
Low Zone Temp										x	
Totals	**2**	**0**	**2**	**1**	**2**	**0**	**0**	**1**	**6**	**3**	**7**

Total Hardware (5) **Total Software (12)**

3.20 CONTROL DAMPER INSTALLATION

A. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.
B. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure ¼ in. larger than damper dimensions and shall be square, straight, and level.
C. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 0.3 cm (1/8 in.) of each other.
D. Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.
E. Install extended shaft or jackshaft according to manufacturer’s instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)
F. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, all sections must open and close simultaneously.
G. Provide a visible and accessible indication of damper position on the drive shaft end.
H. Support ductwork in area of damper when required to prevent sagging due to damper weight.
I. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

3.21 DUCT SMOKE DETECTION

A. Submit data for coordination of duct smoke detector interface to HVAC systems as required in Part 1, "Submittals."
B. This Contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

3.22 CONTROLS COMMUNICATION PROTOCOL

A. General. The electronic controls packaged with this equipment shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control setpoints as shown in the points list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as defined in ANSI/ASHRAE Standard 135 (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of Standard 135.
B. Distributed Processing. The controller shall be capable of stand-alone operation and shall continue to provide control functions if the network connection is lost.
C. I/O Capacity. The controller shall contain sufficient I/ O capacity to control the target system.
D. The Controller shall have a physical connection for a laptop computer or a portable operator’s tool.
E. Environment. The hardware shall be suitable for the anticipated ambient conditions.

    1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 40°C to 60°C (40°F to 140°F).
    2. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

F. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.
G. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 30 days.
H. Power. Controller shall be able to operate at 90% to 110% of nominal voltage rating.
I. Transformer. Power supply for the Controller must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.

3.23 START-UP AND CHECKOUT PROCEDURES

A. Start up, check out, and test all hardware and software and verify communication between all components.

    1. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.
    2. Verify that all analog and binary input/output points read properly.
    3. Verify alarms and interlocks.
    4. Verify operation of the integrated system.

APPENDIX A: Glossary of Terms

Terms used within the Specification Text:

- Advanced Application Controller (AAC):

A fully programmable control module. This control module may be capable of some of the advanced features found in Building Controllers (storing trends, initiating read and write requests, etc.) but it does not serve as a master controller. Advanced Application Controllers may reside on either the Ethernet/IP backbone or on a subnet.

- Application Specific Controller (ASC):

A pre-programmed control module which is intended for use in a specific application. ASCs may be configurable, in that the user can choose between various pre-programmed options, but it does not support full custom programming. ASCs are often used on terminal equipment such as VAV boxes or fan coil units. In many vendors' architectures ASCs do not store trends or schedules but instead rely upon a Building Controller to provide those functions.

- BACnet/IP:

An approved BACnet network type which uses an Ethernet carrier and IP addressing.

- BACnet MS/TP:

An approved BACnet network type which uses a Master-Slave Token Passing configuration. MS/TP networks are unique to BACnet and utilize EIA485 twisted pair topology running at 9600 to 76,800 bps.

- BACnet over ARCNET:

An approved BACnet network type which uses an ARCNET (attached resource computer network) carrier. ARCNET is an industry standard that can utilize several speeds and wiring standards. The most common configuration used by BACnet controllers is an EIA485 twisted pair topology running at 156,000 bps.

- Building Controller (BC):

A fully programmable control module which is capable of storing trends and schedules, serving as a router to devices on a subnet, and initiating read and write requests to other controllers. Typically this controller is located on the Ethernet/IP backbone of the BAS. In many vendors' architectures a Building Controller will serve as a master controller, storing schedules and trends for controllers on a subnet underneath the Building Controller.

- Direct Digital Control (DDC):

A control system in which a digital computer or microprocessor is directly connected to the valves, dampers, and other actuators which control the system, as opposed to indirectly controlling a system by resetting setpoints on an analog pneumatic or electronic controller.

- PICS - Protocol Implementation Conformance Statement:

A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device.

- Smart Actuator (SA):

An actuator which is controlled by a network connection rather than a binary or analog signal. (0-10v, 4-20mA, relay, etc.)

- Smart Sensor (SS):

A sensor which provides information to the BAS via network connection rather than a binary or analog signal. (0-10000 ohm, 4-20mA, dry contact, etc.)

- Web services:

Web services are a standard method of exchanging data between computer systems using the XML (extensible markup language) and SOAP (simple object access protocol) standards. Web services can be used at any level within a Building Automation System (BAS), but most commonly they are used to transfer data between BAS using different protocols or between a BAS and a non-BAS system such as a tenant billing system or a utility management system.

Terms used within the Sequences of Operation:

- adj.

Adjustable by the end user, through the supplied user interface.

- AI, AO, etc. (Column Headings on Points List)

AI = Analog Input. A physical input to the control module.
AO = Analog Output. A physical output from the control module.
AV = Analog Value. An intermediate (software) point that may be editable or read-only. Editable AVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read Only AVs are typically used to display the status of a control operation.
BI = Binary Input. A physical input to the control module.
BO = Binary Output. A physical output from the control module.
BV = Binary Value. An intermediate (software) point that may be editable or read-only. Editable BVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read Only BVs are typically used to display the status of a control operation.
Loop = A control loop. Most commonly a PID control loop. Typically a control loop will include a set-point, an input which is compared to the setpoint, and an output which controls some action based upon the difference between the input and the setpoint. A PID control loop will also include gains for the proportional, integral, and derivative response as well as an interval which controls how frequently the control loop updates its output. These gains may be adjustable by the end user for control loop "tuning," but in self-tuning control loops or loops which have been optimized for a specific application the gains may not be adjustable.
Sched = Schedule. The control algorithm for this equipment shall include a user editable schedule.

Trend. The control system shall be configured to collect and display a trend log of this object. The trending interval shall be no less than one sample every 5 minutes. (Change of Value trending, where a sample is taken every time the value changes by more than a user-defined minimum, is an acceptable alternative.)
Alarm. The control system shall be configured to generate an alarm when this object exceeds user definable limits, as described in the Sequence of Controls.

Note: If the specifications require use of the BACnet protocol, all of the above shall be provided as BACnet objects.

- KW Demand Limiting: *

An energy management strategy that reduces energy consumption when a system's electric power meter exceeds an operator-defined threshold.

When power consumption exceeds defined levels, the system automatically adjust setpoints, de-energizes low priority equipment, and takes other pre-programmed actions to avoid peak demand charges. As the demand drops, the system restores loads in a predetermined manner.

- Occupant Override Switch, or Timed Local Override:

A control option that allows building occupants to override the programmed HVAC schedule for a limited period of time.

When the override time expires, the zone returns to its unoccupied state.

- Occupant Setpoint Adjustment:

A control option that allows building occupants to adjust - within limits set by the HVAC control system - the heating and cooling setpoints of selected zones. Typically the user interface for this function is built into the zone sensor.

- Optimal Start-Up: *

A control strategy that automatically starts an HVAC system at the latest possible time yet ensures comfort conditions by the time the building becomes occupied.

In a typical implementation, a controller measures the temperature of the zone and the outside air. Then, using design heating or cooling capacity at the design outside air temperature, the system computes how long a unit must run at maximum capacity to bring the zone temperature to its occupied setpoint.

The optimal start algorithm often includes a self-learning feature to adjust for variations from design capacity.

A distributed system must use Run on Request with Optimal Start. (See below.)

- Requested, or Run on Request: *

A control strategy that optimizes the runtime of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service. Source equipment runs only when needed, not on a fixed schedule.

The source equipment runs when one or more receiving units request its services. An operator determines how many requests are required to start the source equipment.

For example, if all the zones in a building are unoccupied and the zone terminal units do not need heating or cooling, the AHU will shut down. However, if a zone becomes occupied or needs cooling, the terminal unit will send a run request to the AHU to initiate the start-up sequence. If this AHU depends on a central chiller, it can send a run request to the chiller.

The run on request algorithm also allows an operator to schedule occupancy for individual zones based on the needs of the occupants without having to adjust the schedules of related AHUs and chillers.

- Trim and Respond, or Setpoint Optimization: *

A control strategy that optimizes the setpoint of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service.

The source unit communicates with receiving units to determine heating, cooling, and other requirements, and then adjusts its setpoint.

For example, if all zones are comfortable and do not request cooling, the AHU will gradually increase (trim) its supply air setpoint. When a zone requests cooling, the AHU responds by dropping its setpoint. The more zones that request cooling, the more it drops the setpoint. The AHU repeats this process throughout the day to keep zones cool, but with a supply air setpoint that is no cooler than necessary.

Contracting Terms:

- Furnished or Provided:

The act of supplying a device or piece of equipment as required meeting the scope of work specified and making that device or equipment operational. All costs required to furnish the specified device or equipment and make it operational are borne by the division specified to be responsible for providing the device or equipment.

- Install or Installed:

The physical act of mounting, piping or wiring a device or piece of equipment in accordance with the manufacturer's instructions and the scope of work as specified. All costs required to complete the installation are borne by the division specified to include labor and any ancillary materials.

- Interface:

The physical device required to provide integration capabilities from an equipment vendor's product to the control system. The equipment vendor most normally furnishes the interface device. An example of an interface is the chilled water temperature reset interface card provided by the chiller manufacturer in

order to allow the control system to integrate the chilled water temperature reset function into the control system.

- Integrate:

The physical connections from a control system to all specified equipment through an interface as required to allow the specified control and monitoring functions of the equipment to be performed via the control system.

APPENDIX B: Abbreviations

The following abbreviations may be used in graphics, schematics, point names, and other UI applications where space is at a premium.

AC - Air Conditioning
ACU - Air Conditioning Unit
AHU - Air Handling Unit
AI - Analog Input
AO - Analog Output
AUTO - Automatic
AUX - Auxiliary
BI -Binary Input
BO -Binary Output
C -Common
CHW - Chilled Water
CHWP - Chilled Water Pump
CHWR - Chilled Water Return
CHWS - Chilled Water Supply
COND - Condenser
CW - Condenser Water
CWP - Condenser Water Pump
CWR - Condenser Water Return
CWS - Condenser Water Supply
DA - Discharge Air
EA - Exhaust Air
EF - Exhaust Fan
EVAP - Evaporators
FCU - Fan Coil Unit
HOA - Hand / Off / Auto
HP - Heat Pump
HRU - Heat Recovery Unit
HTEX - Heat Exchanger
HW - Hot Water
HWP - Hot Water Pump
HWR - Hot Water Return
HWS - Hot Water Supply
MAX - Maximum
MIN - Minimum
MISC - Miscellaneous
NC - Normally Closed
NO - Normally Open
OA - Outdoor Air
PIU - Powered Induction Unit
RA - Return Air
RF - Return Fan
RH - Relative Humidity
RTU - Roof-top Unit
SA - Supply Air

SF - Supply Fan
SP - Static Pressure
TEMP - Temperature
UH - Unit Heater
UV - Unit Ventilator
VAV - Variable Air Volume
VVTU - Variable Volume Terminal Unit
W/ - with
W/O - without
WSHP - Water Source Heat Pump

END OF SECTION

SECTION 231710
VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of Contact, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 PRINCIPAL WORK IN THIS SECTION

A. Variable frequency drives.

B. Materials, equipment, fabrication, installation and tests, in conformity with applicable codes and authorities having jurisdiction, for variable frequency drives (VFD's).

1.3 QUALITY ASSURANCE

A. Refer to General Provisions.

B. Manufacturer: Company specializing in manufacture of variable frequency drives and their accessories, with minimum ten years documented product development, testing, and manufacturing experience in the horsepower range required.

C. VFD's shall have a minimum MTBF (mean time between failure) rating of 28 years.

1.4 SUBMITTALS

A. Submit product data, drawings and diagrams for the following items per the provisions of Division 1 and this Division's General provisions:

1. Product data: Manufacturer's catalog cuts, ratings and installation instructions.

2. Drawings: Scale drawings of assembly.

3. Diagrams: wiring diagrams including all external connections.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Variable Frequency Drives:

1. Square D.

2. ABB

3. Danfoss Graham.

2.2 VARIABLE FREQUENCY DRIVES

A. General:

1. Motors shall be provided with UL Listed variable frequency drive (VFD) control systems.

2. Motors shall be provided with a microprocessor based, pulse width modulated (PWM) variable frequency drive (VFD) control systems as specified or noted.

3. The adjustable frequency AC motor drive shall be designed to convert the 60 hertz input power to adjustable frequency output power. The output frequency and voltage of the drive shall be adjustable such that a constant volts/Hz ratio is determined from the design parameters of the driven motor.

4. Drive shall be capable of operating any standard squirrel cage induction motor with load rating within the capacity of the drive. At any time in the future, it shall be possible to substitute a new or rewound motor in the field without requiring modification of the drive.

5. For retrofit projects, Contractor shall be familiar with existing motor conditions. Existing motor must have a 1.15 service factor and Class B insulation. VFD shall be sized for current voltage and HP of existing motor. Any motors not meeting these minimum requirements shall be replaced and provided by the Contractor.

6. For maintenance purposes, drive shall be capable of starting, stopping and running with stable operation with the motor completely disconnected (no load).

7. Input AC line reactor shall be provided by manufacturers of VFD.

B. Features:

1. Drive enclosure shall be a NEMA Type 1 or equivalent, wall or floor mounted, metal cabinet with hinged front access door(s), filtered ventilation system (if required), and controls that are mounted, wired and tested.

2. Fused, interlocked disconnect switch or input line circuit breaker, externally operated, interlocked with enclosure door. Short circuit interrupting rating of 200,000 amps.

3. Internal 115 VAC control power circuit with transformer and primary and secondary protective fuses.

4. One normally open and one normally closed contacts from run relay, wired to terminal for customer use. Contactors to enable control of drive from a central control system for start/stop and load shed operation through remote speed reset.

5. Controlled acceleration and deceleration, separately adjustable, shall be provided from 0.5 to 200 seconds with torque limit override acceleration

protection and regeneration protection during deceleration.

6. Drive shall automatically adjust the volts/Hz ratio to the motor in proportion to its load without changing speed in order to conserve the maximum amount of energy.

7. Separately adjustable maximum and minimum frequency limits shall be provided.

8. Low frequency/low voltage start with linearly adjustable ramp up to pre-selected speed.

9. All components shall be accessible from the cabinet door for service. Drive must be designed for side-by-side, back-to-back and against-the-wall installation.

10. Digitally displayed AC ammeter and percent load meter, located on door.

11. Digitally displayed speed control and speed indicator, located on door.

12. Digitally displayed voltmeter, located on door.

13. Hand/off/auto switch with start/stop pushbuttons or switches.

    a. In the "hand" position, the speed is controlled by the door mounted speed control and the start/stop commands are controlled by the door mounted start/stop pushbuttons or switches.

    b. In the "off" position, the drive cannot be started.

    c. In the "auto" position, the speed is controlled by a remote electronic signal and the drive can receive only a remote start command (momentary contact closure). The stop command in the auto position can be either remote or from the door mounted stop pushbutton or switch (to ensure maximum safety).

    d. To facilitate equipment setup, the drive shall not undergo complete shutdown when moving the selector switch from the hand position to the auto position.

14. Drive fault alarm contact for remote indication.

15. Automatic reset of drive to receive start command after any normal shutdown, including power outages.

16. Remote electrical input signal for speed control(to be coordinated with control Contractor).

17. Critical speed rejection circuit.

18. Drive shall be constructed with integral protection against all normal transients and surges in the incoming power line, any grounding or disconnecting of the output power line, and any interruption or runaway of the incoming speed

reference signal. Protection is defined as a normal shutdown or return to original speed with no component damage.

19. Drive shall protect itself against all phase-to-phase and phase-to-ground faults.

20. Drive shall protect itself against any removal of load.

21. Drive shall employ adjustable torque limit control to override the speed command and decrease the frequency while maintaining the correct volts/Hz ratio whenever the load level surpasses the drive design level.

22. Drive shall protect itself against single-phasing and power outages and shall be insensitive to input phase rotation.

23. Drive shall start into a spinning motor or shut down with no component damage.

24. Drive shall ride through any input power dip of three cycles or less.

25. Drive shall go through an orderly shutdown when the incoming voltage low limit is surpassed.

26. Instantaneous overcurrent trip (IOT) shall continuously monitor peak currents. It shall provide instantaneous shutdown without component failure when high limit setting is surpassed.

27. Torque limit shall be settable from 50 to 100 percent of full drive rating on variable torque loads. When torque limit engages, the output frequency is steadily reduced until the load reduces to the design capacity. At that point, the speed will stabilize. If the load reduces further, the drive shall re-accelerate to the preset speed.

28. Manual bypass shall be provided when indicated by the schedule. VFD and bypass components shall be mounted inside a common NEMA 1 enclosure, fully pre-wired and ready for installation as a single UL listed device. Bypass shall include the following:

    a. Input, output, and bypass contactors, to disconnect power to the VFD, when the motor is running in the bypass mode.

    b. 115 V.A.C. control transformer, with fused primary.

    c. Thermal overload relay, to protect the motor while operating in the bypass mode.

    d. Circuit breaker/disconnect switch, with a “through-the-door” handle mechanism.

    e. Control and safety circuit terminal strip.

    f. “Drive-Off-Bypass” selector switch.

g. Pilot lights for “Power On” and “Fault”.

h. “Normal/Test” selector switch, to allow testing and adjustment of the VFD while the motor is running in the bypass mode.

29. UL listed, nonlinear isolation transformer to prevent noise and harmonic feedback to electrical system. Shall be mounted in NEMA 1 enclosure and be of dry type construction with Class H insulation. Transformer shall be provided by variable frequency drive manufacturer to match performance of variable frequency drive(s).

30. The VFD must meet the requirements for Radio Frequency Interference (RFI) above 7 MHz as specified by FCC regulations, part 15, subpart J, Class A devices.

31. A digital diagnostic system which monitors its own control functions and displays faults and operating conditions.

32. Operating conditions:

a. Line voltage variations: +10 percent, -5 percent.

b. Line frequency variations: ±2 hertz.

c. Overload capability of up to 130 percent of full drive rating for variable torque loads.

d. Ambient temperature: 0ºC to 40ºC.

e. Maximum altitude limit: 3,300 feet.

f. Maximum humidity: 95 percent (non-condensing).

g. Efficiency in excess of 95 percent at full load/full speed and in excess of 80 percent at half speed on a variable torque load (cubic load).

33. Serial communication.

34. VFD shall be capable of PID (Proportional, Integral, Derivative) logic, to provide closed-loop setpoint control capability, from a remote reference. In addition, an energy saving sleep function should be used in conjunction with the PID control. The SLEEP function reduces the unnecessary operation of equipment. When the SLEEP function senses a minimal deviation of a sensor (pressure, temperature), the system reacts by removing the run signal from the equipment. Upon receiving an ample sensor signal deviation, the equipment returns the run signal and resumes normal operation.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Coordinate drive equipment with motors supplied under Motors and Motor Controllers.

C. Factory representative shall inspect final installation of all drives and connected wiring and make all final adjustments to meet specified performance.

3.2 TESTS

A. Manufacturer shall conduct factory tests to assure conformance to specification requirements.

B. All power components shall be run-tested under specified temperature and load conditions.

C. Complete records of test procedure and results shall be made available at no cost to Owner's representative.

3.3 TRAINING

A. Factory representative shall provide on-site training of operating personnel after the system is fully operational.

3.4 WARRANTY

A. Three-year warranty from date of shipment.

END OF SECTION

SECTION 232113
HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.
2. Chilled-water piping.
3. Air-vent piping.
4. Safety-valve-inlet and -outlet piping.

B. Related Sections include the following:

1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.3 DEFINITIONS

A. PTFE: Polytetrafluoroethylene.

1.4 SUBMITTALS

A. Product Data: For each type of the following:

1. Pipe materials and fittings.
2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
3. Air control devices.
4. Chemical treatment.
5. Hydronic specialties.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L

B. Wrought-Copper Fittings: ASME B16.22.

C. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. T-DRILL Industries Inc.

D. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Unions: ASME B16.39; Class 150 as indicated in Part 3 "Piping Applications" Article.

D. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

E. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

G. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.

2. Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Factory-fabricated companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Calpico, Inc.
b. Lochinvar Corporation.

2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Perfection Corporation; a subsidiary of American Meter Company.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Company, Inc.
d. Victaulic Company of America.

2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Direct Digital Control System for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong Pumps, Inc.
b. Bell & Gossett Domestic Pump; a division of ITT Industries.
c. Flow Design Inc.
d. Gerand Engineering Co.
e. Griswold Controls.
f. Taco.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.

9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

2.6 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Spirotherm
2. Wessels
3. Amtrol, Inc.
4. Armstrong Pumps, Inc.
5. Bell & Gossett Domestic Pump; a division of ITT Industries.
6. Taco.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

D. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

E. Combination Air and Dirt Separators:

1. Full flow coalescing type combination air eliminator and dirt separator shall be fabricated steel, rated for 150 psig working pressure, stamped and registered in

accordance with ASME Section VIII, Division 1 for unfired pressure vessels, and include two equal chambers above and below the inlet / outlet nozzles.

2. Selection shall be based upon system flow with pipe size as a minimum. In no case shall entering velocity exceed 10 feet per second.
3. Unit shall include internal structured elements filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100% free air, 100% entrained air, and 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. The elements must be fabricated by the manufacturer and consist of a copper core tube with continuous wound copper wire medium permanently attached and followed by a separate continuous wound copper wire permanently affixed.
4. Each unit shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism.
5. Units shall include a side tap valve to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill.
6. Unit shall be manufactured with a removable lower head for internal inspection and cleaning.

2.7 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.

3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Chilled-water piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
2. Schedule 40 steel pipe; Class 150, malleable-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

E. Makeup-water piping installed aboveground shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

F. Air-Vent Piping:

1. Inlet: Same as service where installed.
2. Outlet: Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

G. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

C. Install check valves at each pump discharge and elsewhere as required to control flow direction.

D. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

E. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

T. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS ¾ to 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
2. NPS 1-1/2 to 5: Maximum span, 10 feet; minimum rod size, 1/2 inch.

E. Install hangers for drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS ¾ to 1-1/2: Maximum span, 6 feet; minimum rod size, 3/8 inch.
2. NPS 2 and greater: Maximum span, 10 feet; minimum rod size, 1/2 inch.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install air and dirt separator in vertical position.

D. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

E. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

F. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:

1. pH: 9.0 to 10.5.
2. "P" Alkalinity: 100 to 500 ppm.
3. Boron: 100 to 200 ppm.
4. Chemical Oxygen Demand: Maximum 100 ppm.

5. Corrosion Inhibitor:

    a. Sodium Nitrate: 1000 to 1500 ppm.
    b. Molybdate: 200 to 300 ppm.
    c. Chromate: 200 to 300 ppm.
    d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
    e. Chromate Plus Molybdate: 50 to 100 ppm each.

6. Soluble Copper: Maximum 0.20 ppm.
7. Tolyiriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum 10 ppm.
8. Total Suspended Solids: Maximum 10 ppm.
9. Ammonia: Maximum 20 ppm.
10. Free Caustic Alkalinity: Maximum 20 ppm.
11. Microbiological Limits:

    a. Total Aerobic Plate Count: Maximum 1000 organisms/ml.
    b. Total Anaerobic Plate Count: Maximum 100 organisms/ml.
    c. Nitrate Reducers: 100 organisms/ml.
    d. Sulfate Reducers: Maximum 0 organisms/ml.
    e. Iron Bacteria: Maximum 0 organisms/ml.

B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

C. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION

SECTION 232113.13
UNDERGROUND HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic pipe and fittings.
2. Transition fittings.
3. Cased piping system.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing hydronic piping systems with the following minimum working-pressure ratings:

1. Hot-Water Piping: 100 psig at 200 deg F.
2. Chilled-Water Piping: 100 psig at 200 deg F.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Cased piping.

B. Shop Drawings: For underground hydronic piping. Signed and sealed by a professional engineer.

1. Calculate requirements for expansion compensation for underground piping.
2. Show expansion compensators, offsets, and loops with appropriate materials to allow piping movement in the required locations. Show anchors and guides that restrain piping movement with calculated loads and show concrete thrust block dimensions.
3. Show pipe sizes, locations, and elevations. Show piping in trench, conduit, and cased pipe with details showing clearances between piping, and show insulation thickness.

C. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and at vertical scale of not less than 1 inch equals 5

feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing hydronic piping.

D. Qualification Data: For qualified Installer.

E. Welding certificates.

F. Material Test Reports: For cased piping.

G. Source quality-control reports.

H. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31.9, "Building Services Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 - PRODUCTS

2.1 PLASTIC PIPE AND FITTINGS

A. HDPE Plastic:

1. Pipe: ASTM D-3350, plain ends as indicated in "Piping Application" Article.
2. Pipe Fittings: Fittings shall be heat fusion butt-welded to adjacent pipe sections.

2.2 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC one-piece fitting with one threaded brass or copper insert and one Schedule 80 solvent-cemented-joint end.

2.3 CASED PIPING SYSTEM

A. Description: Factory-fabricated piping with carrier pipe, insulation, and casing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Insul-Tek Piping Systems, Inc.
b. Perma-Pipe, Inc.

c. Rovanco Piping Systems, Inc.
d. Thermacor Process, L.P.
e. Thermal Pipe Systems.
f. Urecon Ltd.

B. Carrier Pipe: Plastic pipe and fittings.

C. Carrier Pipe Insulation:

1. Polyurethane Foam Pipe Insulation: Rigid, cellular, high-pressure injected between carrier pipe and jacket.

a. Comply with ASTM C 591; thermal conductivity (k-value) shall not exceed 0.16 Btu x in./h x sq. ft. x deg F at 75 deg F after 180 days of aging.

D. Casing: HDPE.

E. Casing accessories include the following:

1. Joint Kit: Half-shell, pourable or split insulation, casing sleeve, and shrink-wrap sleeve.
2. Expansion Blanket: Elastomeric foam, formed to fit over piping.
3. End Seals: Shrink wrap the casing material to seal watertight around casing and carrier pipe.

PART 3 - EXECUTION

3.1 EARTHWORK

A. See Division 31 Sections for excavating, trenching, and backfilling.

3.2 PIPING APPLICATION

A. Hot-Water Piping:

1. Shall be the following:

a. HDPE plastic pipe and fittings.

2. Cased piping with polyurethane carrier-pipe insulation.

a. Piping Insulation Thickness: 2 inch.

B. Chilled-Water Piping:

1. Shall be the following:

a. HDPE plastic pipe and fittings.

2. Cased piping with polyurethane carrier-pipe insulation.

    a. Piping Insulation Thickness: 1 inch.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Remove standing water in the bottom of trench.

C. Do not backfill piping trench until field quality-control testing has been completed and results approved.

D. Install piping at uniform grade of 0.2 percent. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points and elsewhere as required for system drainage. Install manual air vents at high points.

E. Install components with pressure rating equal to or greater than system operating pressure.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. See Division 23 Section "Common Work Results for HVAC" for sleeves and mechanical sleeve seals through exterior building walls.

I. Secure anchors with concrete thrust blocks. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

J. See Division 26 Section "Cathodic Protection" for cathodic devices and connections to piping and conduit systems.

3.4 JOINT CONSTRUCTION

A. See Division 33 Section "Common Work Results for Utilities" for basic piping joint construction.

B. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

D. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

E. Straight run joints consisting of pipe and jacket are butt fusion welded and field insulated using urethane foam to the thickness specified and jacketed with a heat shrinkable sleeve over the HDPE sleeve mold. Joints can be made beside the trench or inside the trench.

F. Carrier pipe fittings of the same material and pressure rating shall be heat fusion butt-welded to adjacent pipe sections. Fittings that are butt fusion welded are to be field installed or, at engineer's option, factory insulated. If fittings are factory manufactured, fittings are pre-insulated using factory PE fitting covers welded to the jackets.

3.5 IDENTIFICATION

A. Install continuous plastic underground warning tapes during back filling of trenches for underground hydronic piping. Locate tapes 6 to 8 inches below finished grade, directly over piping. See Division 31 Sections for warning-tape materials and devices and their installation.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Prepare hydronic piping for testing according to ASME B31.9 and as follows:

    a. Leave joints, including welds, uninsulated and exposed for examination during test.
    b. The piping system shall be restrained from uncontrolled movement in the event of a failure. Appropriate safety precautions shall be taken to guard against possible injury to personnel in the event of a failure.
    c. Fill system with water. Where there is risk of freezing, air or a safe, compatible liquid may be used.
    d. Use vents installed at high points to release trapped air while filling system.
    e. Expansion phase: Initial pressurization period of three hours at one and one-half times the normal system operating pressure. Make-up water shall be added to the system during this period to maintain the desired pressure.

2. Test hydronic piping as follows:

    a. The test shall commence immediately after the expansion phase. The pressure shall be reduced by 10 psi and the test clock started.
    b. System pressure remaining within 5% of the target test pressure for one hour indicates no leakage has occurred.

c. If the entire test procedure cannot be completed within eight hours of the initial pressurization, the system shall be depressurized and allowed to relax for a minimum of eight hours before another test is attempted.
d. After hydrostatic test pressure has been applied, examine joints for leakage. Remake leaking joints using new materials and repeat hydrostatic test until no leaks exist.

3. Test conduit as follows:

a. Seal vents and drains and subject conduit to 15 psig for four hours with no loss of pressure. Repair leaks and retest as required.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 232123
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Close-coupled, in-line centrifugal pumps.

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of hydronic pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Available Manufacturers:

1. Bell & Gossett; Div. of ITT Industries.
2. Taco, Inc.
3. Armstrong Pumps Inc.
4. Grundfos Pumps Corporation.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 250 deg F.

C. Pump Construction:

1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
3. Pump Shaft: Stainless steel.

4. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.

5. Pump Bearings: Permanently lubricated ball bearings.

D. Motor: Single speed, with permanently lubricated ball bearings, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

E. Capacities and Characteristics: Refer to Equipment Schedules on plans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

3.3 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.

B. Comply with pump and coupling manufacturers' written instructions.

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install check valve and throttling valve on discharge side of pumps.

F. Install Y-type strainer and shutoff valve on suction side of pumps.

G. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.

H. Install electrical connections for power, controls, and devices.

I. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 232300
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 185 psig (1276 kPa).
2. Suction Lines for Heat-Pump Applications: 325 psig (2241 kPa).
3. Hot-Gas and Liquid Lines: 325 psig (2241 kPa).

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.4 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B) or ASTM B280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig (3450 kPa).

C. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat Disc: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig (2760 kPa).
6. Maximum Operating Temperature: 240 deg F (116 deg C).

D. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F (4.4 deg C).
6. Superheat: Nonadjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 450 psig (3100 kPa).

E. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig (3450 kPa).
5. Maximum Operating Temperature: 275 deg F (135 deg C).

F. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig (3450 kPa).
6. Maximum Operating Temperature: 275 deg F (135 deg C).

G. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

H. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.

4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.

6. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig (14 kPa).
8. Working Pressure Rating: 500 psig (3450 kPa).
9. Maximum Operating Temperature: 240 deg F (116 deg C).

2.3 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-410A: Difluoromethane and Pentafluoroethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-Gas and Liquid Lines, and Suction Lines for Air Conditioning and Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at strainers if they are not an integral part of strainers.

C. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

D. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.

2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

E. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

F. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

G. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Compressor.

H. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

I. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install piping per equipment manufacturers requirements and guidelines for slope, distance, changes in direction, changes in elevation and branching.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.

3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

Q. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

S. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

T. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

U. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 PIPE JOINT CONSTRUCTION

A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2 (DN 15) and smaller: Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
6. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
7. NPS 2-1/2 (DN 65): Maximum span, 108 inches (2700 mm); minimum rod size, 3/8 inch (9.5 mm).
8. All sizes, provide supports within 12 inches of all changes in direction.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

a. Fill system with nitrogen to the required test pressure.
b. System shall maintain test pressure at the manifold gage throughout duration of test.
c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures and per equipment manufacturers instructions:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Verify that compressor oil level is correct.
2. Open compressor suction and discharge valves.
3. Open refrigerant valves except bypass valves that are used for other purposes.
4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 233113
METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Nonmetal Ducts" for fabric ducts.
3. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.3 SUBMITTALS

A. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.

B. Product Data: For each type of product indicated.

C. Shop Drawings:

1. Duct layout indicating sizes, configuration, liner material/thickness, and static-pressure classes.
2. Elevation of top of ducts.
3. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Provide Drive Slip or Hemmed “S” Slip or approved equal.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Provide Drive Slip or Hemmed “S” Slip or approved equal.

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. McGill AirFlow LLC.
    b. SEMCO Incorporated.
    c. Sheet Metal Connectors, Inc.
    d. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 (Z180).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.

2. Maximum Thermal Conductivity:

a. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

3. Sound Absorption Coefficients:

a. Type II, Rigid: NRC minimum 0.85 at 3.0 PCF and 1-1/2” thickness.

4. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
5. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-(0.41-mm-) thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors installed and/or stored on site from moisture, construction debris and dust, and other foreign materials.

1. Cover and seal open ends of ducts with plastic wrap and duct tape.
2. Turn off ventilation system and protect duct interiors from dust infiltration during dust producing activities (e.g. demolition, drywall installation, finishing).
3. At the end of each workday, cover and seal open ends or openings of installed ducts with plastic wrap and duct tape.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces as detailed on drawings to support the duct and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7.

B. Provide seismic-restraint devices as detailed on drawings with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

A. Paint exterior of metal ducts that are visible.

B. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner.

C. Paint materials and application requirements are specified in Division 09 painting Sections.

3.9 FIELD QUALITY CONTROL

A. Perform duct leakage tests and inspections per California Mechanical Code 2022, 603.9.2.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class of 2-Inch wg or higher: Test representative duct sections totaling no less than 10 percent of total installed duct area for each designated pressure class. Where the tested 10 percent fail to comply with the requirements of this section, the 40 percent of the total installed duct area shall be tested. Where the tested 40 percent fail to comply with the requirements of this section, then 100 percent of the total installed duct area shall be tested.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

3.10 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel or stainless sheet steel as indicated below.

B. Supply and Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Galvanized sheet steel.
    b. Pressure Class: Positive 2-inch wg (500 Pa).

c. Minimum SMACNA Seal Class: B.
d. SMACNA Leakage Class for Rectangular: 12.
e. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Variable-Volume Air-Handling Units:

a. Galvanized sheet steel.
b. Pressure Class: Positive 3-inch wg (500 Pa).
c. Minimum SMACNA Seal Class: B.
d. SMACNA Leakage Class for Rectangular: 12.
e. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Galvanized sheet steel.
b. Pressure Class: Positive 2-inch wg (500 Pa).
c. Minimum SMACNA Seal Class: B.
d. SMACNA Leakage Class for Rectangular: 12.
e. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Galvanized sheet steel.
b. Pressure Class: Negative 2-inch wg (500 Pa).
c. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
d. SMACNA Leakage Class for Rectangular: 12.
e. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Type 304, stainless-steel sheet, No. 3 finish.
b. Welded seams and joints.
c. Pressure Class: Positive or negative 2-inch wg.
d. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
e. SMACNA Leakage Class: 3.

3. Ducts Connected to Dishwasher Hoods:

a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 3 finish.
c. Concealed: No. 2D finish.
d. Welded seams and flanged joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative 2-inch wg.
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: 3.

D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Galvanized sheet steel.
b. Pressure Class: Positive or negative 1-inch wg (250 Pa).
c. Minimum SMACNA Seal Class: A.
d. SMACNA Leakage Class for Rectangular: 12.
e. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.

b. Not Exposed to Airstream: Match duct material.

F. Liner:

1. Supply Air Ducts, first 15 feet after air handler: Fibrous glass, Type II, 2 inches thick.
2. Supply Air Ducts, beyond 15 feet after air handler: Fibrous glass, Type II, 1-1/2 inches thick.
3. Return Air Ducts, first 15 feet after air handler: Fibrous glass, Type II, 2 inches thick.
4. Return Air Ducts, beyond 15 feet after air handler: Fibrous glass, Type II, 1-1/2 inches thick.
5. Exhaust Air Ducts: Fibrous glass, Type II, 1-1/2 inches thick.
6. Supply Fan Plenums: Fibrous glass, Type II, 2 inches thick.
7. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
8. Transfer Ducts: Fibrous glass, Type II, 1-1/2 inches thick.
9. Outside Air Ducts: Fibrous glass, Type I, 1-1/2 inches thick.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Velocity 1000 fpm (5 m/s) or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

c. Velocity greater than 1500 fpm:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Spot welded seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections" and details provided on drawings.

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: 45 degree Lead-In, Low-loss.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and details provided on drawings.

a. All shall be 45-degree lateral.

END OF SECTION

SECTION 233116
NONMETAL DUCTS

PART 1-GENERAL

1.01 DESCRIPTION OF WORK:

A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.

B. Types of non-metal ductwork required for this project include the following:

1. Textile air Dispersion Products.

1.02 QUALITY ASSURANCE:

A. Building Codes and Standards:

1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and are also classified in accordance with ICC Evaluation Service AC167 and UL2518.
2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.
3. Product must be treated with an EPA registered antimicrobial agent.
4. Green Product: Product must be constructed of a minimum 55% recycled content
5. Fabrics shall meet minimum criteria or use in ISO Class 3 application as defined by ISO 14644-1.

B. Design & Quality Control

1. Manufacturer must have documented design support information including duct sizing, vent and orifice location, vent and orifice sizing, length, and suspension. Parameters for design, including maximum air temperature, velocity, pressure and fabric permeability, shall be considered and documented.

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.

B. Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories for NFPA 90-A, ICC AC167 and UL2518.

1.04 WARRANTY

A. Manufacturer must provide a 10 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Protect textile air dispersion systems from damage during shipping, storage and handling.

B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

PART 2 – PRODUCTS

2.01 MANUFACTURER:

Subject to compliance with requirements, choose one of the following:

A. DuctSox® Corporation

B. Fabric Air

2.02 TEXTILE AIR DISPERSION SYSTEM:

A. TUFTEX Fabric: Air diffusers shall be constructed of a woven fire retardant fabric complying with the following physical characteristics:

1. Fabric Construction: Fabric shall be constructed of a polyester that includes 55% recycled content, treated with a machine wash-able anti-microbial agent by the fabric manufacturer, of a non-linting filament yarn to meet the requirements of ISO Class 3 environment, and 100% flame retardant.
2. Weight: 8.2 oz. /yd^2 per ASTM D3776
3. Color: From Manufacturer's standard colors as selected by District.
4. Fabric Porosity: None.
5. Temperature Range: 0 degrees F to 180 degrees F
6. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the flame spread/smoke developed requirements NFPA 90, ICC AC167 and UL 2518.
7. Antimicrobial agent shall be proven 99% effective after 10 laundry cycles per AATCC Test Method 100.
8. Customization, per major duct run (typ. of 2)

    a. Contractor to provide field mock-up of customization for Owner review and verification of image/text placement prior to final installation.

B. SEDONA-XM Fabric: Air diffusers shall be constructed of a woven fire retardant fabric complying with the following physical characteristics:

1. Fabric Construction: Fabric shall be constructed of a polyester that includes 55% recycled content, treated with a machine wash-able anti-microbial agent by the fabric manufacturer, of a non-linting filament yarn to meet the requirements of ISO Class 3 environment, and 100% flame retardant.
2. Weight: 6.8 oz. /yd^2 per ASTM D3776
3. Color: From Manufacturer's standard colors as selected by District.
4. Fabric Porosity: 2 CFM/ft^2 @ 0.5 in. w.g.
5. Temperature Range: 0 degrees F to 180 degrees F
6. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the flame spread/smoke developed requirements NFPA 90, ICC AC167 and UL 2518.
7. Antimicrobial agent shall be proven 99% effective after 10 laundry cycles per AATCC Test Method 100.
8. Customization, per major duct run (typ. of 5)

    a. Contractor to provide field mock-up of customization for Owner review and verification of image/text placement prior to final installation.

C. SYSTEMS FABRICATION REQUIREMENTS:

1. Air dispersion accomplished by linear vent. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting at 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
2. Size of vent openings and location of linear vents to be specified and approved by manufacturer.
3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via. zip screw fastener – supplied by contractor.
4. Inlet connection includes zipper for easy removal / maintenance.
5. Lengths to include required zippers as specified by manufacturer.
6. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
7. End cap includes zipper for easy maintenance.
8. Fabric system shall include connectors to accommodate suspension system listed below.
9. Any deviation from a straight run shall be made using a gored elbow or an efficiency tee. Normal 90 degree elbows are 5 gores and the radius of the elbow is 1.5 times the diameter of the DuctSox.

D. DESIGN PARAMETERS:

1. Use fabric diffusers only for positive pressure air distribution components of the mechanical ventilation system.
2. Do not use fabric diffusers in concealed locations.

3. Fabric diffusers shall be designed from 0.25” water gage minimum to 3.0” maximum, with 0.5” as the standard.
2. Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
3. Design CFM, static pressure and diffuser length shall be designed or approved by the manufacturer.

E. SUSPENSION HARDWARE:

1. Fabric Tensioning System: System shall be installed using cylindrical tensioning rings, spacer tubing, and intermediate support rings. Tensioning rings and support rings to be supported by steel wire at 6 feet O.C. Hardware to include cable, eye bolts, thimbles, cable clamps, and turnbuckle(s) as required. Fabric tensioning system to allow no deflation of fabric duct when system is not in use.

   Component options include:

   a. Galvanized Steel Cable
   b. Stainless Steel Cable
   c. Plastic Impregnated Steel Cable

PART 3 – INSTALLATION

3.01 INSTALLATION OF TEXTILE AIR DISPERSION SYSTEM:

A. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

3.02 CLEANING AND PROTECTION:

A. Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.

B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.

C. If DuctSox systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Flange connectors.
4. Duct Silencers
5. Turning vanes.
6. Remote damper operators.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Flexible ducts.
10. Duct accessory hardware.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 3 finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ventfabrics, Ventlok
2. Duro Dyne Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff; a division of PCI Industries, Inc.
6. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 1-inch wg.

E. Frame: 0.052-inch-thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, maximum 6-inch width, [0.025-inch- thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Vinyl foam.

I. Blade Axles:

1. Material: Galvanized steel or Stainless steel.
2. Diameter: 0.20 inch.

J. Return Spring: Adjustable tension.

K. Bearings: Steel ball or Synthetic pivot bushings.

L. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.

5. Screen Mounting: Front mounted in sleeve.

a. Sleeve Thickness: 20-gage minimum.
b. Sleeve Length: 6 inches minimum.

6. Screen Mounting: Rear mounted.
7. Screen Material: Galvanized steel or Aluminum.
8. Screen Type: Bird.
9. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. Ventfabrics, Ventlok.
b. McGill AirFlow LLC.
c. METALAIRE, Inc.
d. Nailor Industries Inc.
e. Pottorff; a division of PCI Industries, Inc.
f. Ruskin Company.
g. Duro Dyne Inc.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.

4. Frames:

    a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel or Stainless steel.
7. Bearings:

    a. Molded synthetic or Stainless-steel sleeve.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, spring loaded, serrated die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.5 DUCT SILENCERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide BRD HushCore or comparable product by one of the following:

1. Industrial Noise Control, Inc.
2. McGill AirFlow LLC.
3. Ruskin Company.
4. Vibro-Acoustics.

B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.

3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2016.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.
3. Rectangular elbow with splitters or baffles.
4. Round elbow with center bodies or pods.
5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: 16 GA galvanized sheet steel.

E. Inner Casing and Baffles: 22 GA galvanized sheet metal with 1/8-inch-diameter perforations.

F. Special Construction:

1. High transmission loss to achieve STC 45.

G. Connection Sizes: Match connecting ductwork unless otherwise indicated.

H. Acoustic Media: Glass Fiber

I. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Lock form and seal or continuously weld joints.

2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
3. Reinforcement: Cross or trapeze angles for rigid suspension.

2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
6. Aero Dyne HEP

B. Manufactured Turning Vanes for Metal Ducts: Double wall, hollow metal, airfoil shape blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Double wall.

2.7 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff; a division of PCI Industries, Inc.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed, 2 inches deep.

F. Wall-Box Cover-Plate Material: Stainless steel.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

    a. Double wall, rectangular.
    b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    c. Vision panel.
    d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
    e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

    a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
    b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
    c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.

2.9 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.

2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.11 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
4. J.P. Lamborn Co.

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.

4. Insulation R-Value: R-8.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.12 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, outside-air and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Connect ducts to duct silencers rigidly.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Control devices requiring inspection.
2. Kitchen exhaust ductwork.
3. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect terminal units to supply ducts directly.

O. Connect diffusers to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

P. Connect flexible ducts to metal ducts with adhesive plus stainless steel band.

Q. Install duct test holes where required for testing and balancing purposes.

R. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 233423
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations as detailed on plans

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Greenheck.
2. Loren Cook Company.
3. Twin City
4. Penn Ventilation.
5. CaptiveAire.

B. Description: Direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains. Provide grease collector on kitchen fans.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Direct Drive Motors:
   1. Open type motor enclosure with DC electronic commutation type motor (ECM) specifically designed for fan applications.
   2. Motors are permanently lubricated heavy duty ball bearing type to match with the fan load.
   3. Motor speed controllable down to 20% of full speed, controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal
   4. Motor shall be a minimum 85% efficient at all speeds.

F. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

   1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
   4. Fan and motor isolated from exhaust airstream.

G. Accessories:

   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
   3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
   4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

H. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

   1. Configuration: Self-flashing without a cant strip, with mounting flange

   2. Overall Height: 14 inches minimum.

   3. Pitch Mounting: Manufacture curb for roof slope.
   4. Vented Curb: Unlined with louvered vents in vertical sides. Height to provide 40” minimum from fan outlet to roof surface.

2.2 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.3 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using elastomeric mounts or restrained spring isolators as indicated on plans, having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to plans for installation of roof curbs.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26.

D. Connect wiring according to Division 26.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 233433
AIR CURTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes air curtains.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each unit.

B. Operation and Maintenance Data: For air curtains to include in maintenance manuals.

C. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air curtains and are based on the specific product indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the California Electrical Code, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with AMCA 220, "Test Methods for Air Curtain Units," for airflow, outlet velocity, and power consumption.

D. ETL Sanitation Listed to comply with NSF 37, "Air Curtains for Entranceways in Food and Food Service Establishments."

1.5 COORDINATION

A. Coordinate layout and installation of air curtains and suspension system components with other construction, including light fixtures, fire-suppression-system components, and partition assemblies.

B. Coordinate installation of wall penetrations and louvers. These items are specified in Division 08 Section "Louvers and Vents."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air curtains that fail in materials or workmanship within specified warranty period.

1. Warranty Period (Nonheating Units): Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Mars Air Products.
2. Berner International Corp.

2.2 MATERIALS

A. Housing Materials: Galvanized steel with electrostatically applied polyurethane powder coating.

1. Mounting Brackets: Steel, for wall mounting.

B. Intake Louvers: Integral part of the housing, mechanically field adjustable and capable of reducing air-outlet velocity by 60 percent with louver in totally closed position.

C. Discharge Nozzle: Integral part of the housing, containing adjustable air-directional vanes with 40-degree sweep front to back.

2.3 FANS

A. Fans: Aluminum, Centrifugal, forward curved, double width, double inlet; statically and dynamically balanced.

B. Fan Drives: Direct

2.4 MOTORS

A. Motor Type: Multispeed, resiliently mounted, continuous duty, totally enclosed, air over, with integral thermal-overload protection.

B. Bearings: Permanently sealed, lifetime, prelubricated, ball bearings.

C. Disconnect: Internal power cord with plug and receptacle.

2.5 FILTERS

A. Washable Panel Filters: Removable, aluminum, baffle-type filters with spring-loaded fastening; with minimum 0.0781-inch-thick, stainless-steel filter frame.

B. Mounting Frames: Welded, galvanized steel with gaskets and fasteners and suitable for bolting together into built-up filter banks.

2.6 ACCESSORIES

A. Automatic Door Switch: Plunger type installed in door area to activate air curtain when door opens and to deactivate air curtain when door closes.

B. Start-Stop, Push-Button Switch: Manually activates and deactivates air curtain.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions where air curtains will be installed for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install air curtains with clearance for equipment service and maintenance.

3.3 CONNECTIONS

A. Ground equipment according to Division 26.

B. Connect wiring according to Division 26.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing air curtains completely, perform visual and mechanical check of individual components.
2. After electrical circuitry has been energized, start unit to confirm motor rotation and unit operation. Certify compliance with test parameters.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Repair or replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust motor and fan speed to achieve specified airflow.

B. Adjust discharge louver and dampers to regulate airflow.

C. Adjust air-directional vanes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air curtains. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 233600
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.

1.2 SUBMITTALS

A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.

1. Air terminal units.
2. Liners and adhesives.
3. Sealants and gaskets.
4. Seismic-restraint devices.

B. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

A. Basis-of-Design Product: Subject to compliance with requirements, provide Titus or comparable product by one of the following:

1. Krueger.
2. Nailor Industries Inc.

3. Price Industries.
4. Trane; a business of American Standard Companies.
5. Tuttle & Bailey.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch steel, single wall.

1. Casing Lining: Adhesive attached, 1/2-inch-thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

D. Regulator Assembly: System-air-powered bellows section incorporating polypropylene bellows for volume regulation and thermostatic control. Bellows shall operate at temperatures from 0 to 140 deg F, shall be impervious to moisture and fungus, shall be suitable for 10-inch wg static pressure, and shall be factory tested for leaks.

E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

F. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

G. Direct Digital Controls: Bidirectional damper operators and microprocessor-based controller and room sensor. Control devices shall be compatible with temperature controls specified in Division 23 Section "Direct Digital Control System for HVAC" and shall have the following features:

1. Damper Actuator: 24 V, powered closed, powered open.
2. Terminal Unit Controller: Pressure-independent, variable-air-volume controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:

a. Occupied and unoccupied operating mode.
b. Remote reset of airflow or temperature set points.
c. Adjusting and monitoring with portable terminal.

d. Communication with temperature-control system specified in Division 23 Section "Direct Digital Control System for HVAC."

3. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.

H. Control Sequence:

1. Suitable for operation with duct pressures between 0.25- and 3.0-inch wg inlet static pressure.
2. System-powered, wall-mounted thermostat.

2.2 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Steel Cables: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to ARI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install hangers and braces to support the air terminal units and to restrain against seismic forces as detailed on the drawings to comply with applicable building codes and ASCE/SEI 7.

B. Install seismic-restraint devices as detailed on the drawings with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on air terminal units that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items before drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Install heavy-duty sleeve anchors with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.4 CONNECTIONS

A. Install piping adjacent to air terminal unit to allow service and maintenance.

B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."

3.5 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Tests and Inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Air terminal unit will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION

SECTION 233813
COMMERCIAL-KITCHEN HOODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes Type I and Type II commercial kitchen hoods.

1.3 DEFINITIONS

A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.

B. Standard Hood: A hood, usually field fabricated, that complies with design, construction, and performance criteria of applicable national and local codes.

C. Type I Hood: A hood designed for grease exhaust applications.

D. Type II Hood: A hood designed for heat and steam removal and for other nongrease applications.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Listed hoods.
2. Filters/baffles.
3. Fire-suppression systems.
4. Lighting fixtures.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D 1.1M, “Structural Welding Code – Steel,” for hangers and supports; and AWS D9.1/D9.1M, “Sheet Metal Welding Code,” for joint and seam welding.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

PART 2 - PRODUCTS

2.1 HOOD MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 430.

1. Minimum Thickness: 0.050 inch.
2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.

a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.

3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
4. Exposed Surfaces: ASTM A 480/A 480M, No. 4 finish (directional satin).
5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Zinc-Coated Steel Shapes: ASTM A 36/A 36M, zinc coated according to ASTM A 123/A 123M requirements.

C. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR, Section 177.2600, for use in areas that come in contact with food.

1. Color: As selected by Architect from manufacturer's full range.
2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

D. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch thickness that does not chip, flake, or blister.

E. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.2 GENERAL HOOD FABRICATION REQUIREMENTS

A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.

1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.

B. For metal butt joints, comply with SMACNA's "Kitchen Equipment Fabrication Guidelines."

C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.

D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.

E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.

F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.

G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.

I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.

J. Fabricate seismic restraints per the Drawings.

K. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Equipment Fabrication Guidelines."

L. Fabricate enclosure panels to ceiling and wall as follows:

1. Fabricate panels on all exposed sides with same material as hood, and extend from ceiling to top of hood canopy and from canopy to wall.
2. Wall Offset Spacer: Minimum of 3 inches.
3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Equipment Fabrication Guidelines," with minimum 0.0625-inch-thick, stainless-steel shelf tops.

2.3 TYPE I EXHAUST HOOD FABRICATION

A. Basis-of-Design Product: Subject to compliance with requirements, provide Captive-Aire Systems or a comparable product by one of the following:

1. Gaylord Industries, Inc.
2. Greenheck.
3. Halton Company.

B. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.

1. Fabricate hoods according to NSF 2, "Food Equipment."
2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
3. Hoods shall be designed, fabricated, and installed according to NFPA 96.
4. Include access panels as required for access to fire dampers and fusible links.
5. Duct Collars: Minimum 0.0598-inch-thick steel at least 3 inches long, continuously welded to top of hood and at corners.

C. Hood Configuration: Exhaust only.

1. Makeup air shall be introduced through transfer air from other spaces.

D. Hood Style: Wall-mounted canopy; Double-island canopy.

E. Filters/Baffles: Removable, stainless-steel, with spring-loaded fastening. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.

F. Lighting Fixtures: Recessed, LED fixtures and lamps with lenses sealed vaportight. Wiring shall be installed in conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc at 30 inches above finished floor.

1. Light switches shall be mounted in hood control panel.
2. Lighting Fixtures: LED complying with UL 1598.

G. Comply with requirements in Division 23 Section "Direct Digital Control for HVAC" and Sequence of Operations listed on plans for hood controls.

H. Hood Controls: Hood- or Wall-mounting control cabinet, factory wired to control groups of adjacent hoods, and fabricated of stainless steel.

1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with fire-suppression system to operate fan(s) during fire-suppression-agent release and to remain in operation until manually stopped. Include red pilot light to indicate fan operation. Motor starters shall comply with Division 26 Sections.

2. Exhaust Fan Interlock: Factory wire the exhaust fan starters in a single control cabinet for adjacent hoods to operate together.
3. Temperature Control: Vary speed of exhaust-air fans with variable-frequency controllers, based on temperature at hood discharge. Interlock fan control with fire-suppression system to operate at high speed during fire-suppression-agent release and to remain in high-speed operation until manually stopped. Controller shall limit exhaust-duct velocity between 500 fpm and 2,000 fpm.
4. High-Temperature Control: Alarm shall sound and cooking equipment shall shut down before hood discharge temperature rises to actuation temperature of fire-suppression system.

I. Capacities and Characteristics: As scheduled and detailed on plans.

2.4 TYPE II EXHAUST HOOD FABRICATION

A. Basis-of-Design Product: Subject to compliance with requirements, provide Captive-Aire Systems or a comparable product by one of the following:

1. Gaylord Industries, Inc.
2. Greenheck.
3. Halton Company.

B. Fabricate hoods according to NSF 2, "Food Equipment."

C. Fabricate hoods to comply with SMACNA's "HVAC Duct Construction Standards: Metal and Flexible."

D. Hood Configuration: Exhaust only.

E. Hood Type: Heat and Condensate removal.

F. Hood Style: Wall-mounted canopy.

G. Capacities and Characteristics: As scheduled and detailed on plans.

2.5 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Captive-Aire Systems or a comparable product by one of the following:

1. Ansul Incorporated; a Tyco International Ltd. Company.
2. Badger Fire Protection.
3. Kidde Fire Systems.
4. Pyro Chem.

B. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," NFPA 96 2011 Edition and UL300 standard 2005 by a qualified testing agency acceptable to authorities having jurisdiction.

1. Steel Pipe, NPS 2 and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends.
2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on hood or wall. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
4. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
5. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
6. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
7. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Complete field assembly of hoods where required.

1. Make closed butt and contact joints that do not require filler.
2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in Part 2 "General Hood Fabrication Requirements" Article.

B. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.

C. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.

D. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.

E. Install hoods to operate free from vibration.

F. Install seismic restraints as detailed on plans.

G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 24 inches o.c. maximum.

H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

J. Set initial temperatures, and calibrate sensors.

K. Set field-adjustable switches.

3.3 CONNECTIONS

A. Connect ducts according to requirements in Division 23 Section "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquid tight joint.

B. Install fire-suppression piping for remote-mounted suppression systems according to UL300 and NFPA 17A, "Wet Chemical Extinguishing Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Test water, drain, gas, and liquid-carrying components for leaks. Repair or replace leaking components.
4. Perform hood performance tests required by authorities having jurisdiction.
5. Perform fire-suppression system performance tests required by authorities having jurisdiction.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial kitchen hoods. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 236423
HEATPUMP MODULAR WATER CHILLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Air-source modular multi-pipe heatpump water chiller system shall consist of individual multi-pipe modules that are assembled on site. Each module shall be completely factory wired and tested prior to shipment. Each module shall include two vapor injection scroll compressors in a tandem compressor set, a brazed plate evaporator, a brazed plate condenser, air-source/sink coil, and controls. The controls shall also be designed to operate on a distributed primary control system which allows each individual secondary microprocessor to operate on its own temperature sensor if there is a failure of the primary microprocessor.

1.3 DEFINITIONS

A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.

B. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

C. IPLV: Integrated part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and referenced to ARI standard rating conditions.

D. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.

E. NPLV: Nonstandard part-load value. A single number part-load efficiency figure of merit calculated per the method defined by ARI 550/590 and intended for operating conditions other than the ARI standard rating conditions.

1.4 SUBMITTALS

A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.

1. Performance at ARI standard conditions and at conditions indicated.
2. Performance at ARI standard unloading conditions.
3. Minimum evaporator flow rate.
4. Refrigerant capacity of water chiller.

5. Minimum entering condenser-air temperature
6. Performance at varying capacity with constant design entering condenser-air temperature. Repeat performance at varying capacity for different entering condenser-air temperatures from design to minimum in 10 deg F increments.

B. Shop Drawings: Complete set of manufacturer's prints of water chiller assemblies, control panels, sections and elevations, and unit isolation. Include the following:

1. Assembled unit dimensions.
2. Weight and load distribution.
3. Required clearances for maintenance and operation.
4. Size and location of piping and wiring connections.
5. Wiring Diagrams: For power, signal, and control wiring.

C. Source quality-control test reports.

D. Startup service reports.

E. Operation and Maintenance Data: For each water chiller to include in emergency, operation, and maintenance manuals.

F. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. AHRI Certification: Certify chiller according to AHRI 590 certification program.

B. AHRI Rating: Rate water chiller performance according to requirements in AHRI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."

C. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.

D. ASHRAE 90.1-2019 Compliance: Applicable requirements in ASHRAE 90.1-2019.

E. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.

F. Comply with NFPA 70.

G. Multi-pipe modules shall be constructed in accordance with the UL 60335 2-40 and NEC standards and be UL or ETL listed.

H. Multi-pipe modules shall be rated and tested in accordance with AHRI 550/590 – Standard for Water Chilling Packages.

I. Multi-pipe modules shall meet the safety standards of ANSI/ASHRAE 15 – Safety Standard for Refrigerated Systems.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Ship water chillers from the factory fully charged with refrigerant and filled with oil.

B. Comply with manufacturer’s installation instructions for rigging, unloading, and transporting multi-pipe modules.

C. Protect multi-pipe modules on site from physical damage after unloading.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within specified period.

1. Compressor Warranty Period: Five years from date of Substantial Completion.

2. Entire multi-pipe system: One year parts and refrigerant.

PART 2 - PRODUCTS

2.1 PACKAGED AIR-COOLED WATER CHILLERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Trane MAS Heat Pump Multi-pipe Modular Chiller or approved equal.

B. Description: Factory-assembled and run-tested water chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories. Each multi-pipe module shall be assembled on a galvanized steel, formed sheet metal frame and be enclosed with epoxy painted galvanized sheet metal panels. The multi-pipe modules shall be shipped as individual modules and assembled on site. Each module shall be fully charged with refrigerant and factory tested for capacity and controller functions prior to shipment. The electrical supply conduit for each module shall be factory assembled and shipped with each module for field

connection into the power distribution panel on the primary module. This provides a single point of power connection for all the modules.

C. Frame: Fabricate base and frame of water chiller components strong enough to resist movement during a seismic event when water chiller base is anchored to field support structure. Frame shall be constructed of formed galvanized 12-gauge sheet metal externally coated with white painted finish. The coating provides a minimum of 1000 hours of salt spray protection.

D. Cabinet: Cabinet panels are made of formed galvanized sheet metal externally coated with white painted finish. The cabinet enclosure shall include easily removable access panels for service. Access panels shall be removable via stainless steel fasteners and retaining clips. Modules shall not require access via sheet metal screws or protruding threaded fasteners.

1. Sound-reduction package consisting of the following:

    a. Acoustic wraps around compressors.
    b. Designed to reduce sound level without affecting performance.

E. Electrical Panels: Each module shall have a high voltage electrical panel where power to each module is connected and a low voltage electrical panel for the module's controller and communication wiring In addition, the system shall have single point power, a power distribution panel shall be provided containing a system lug for the incoming single power supply, a circuit breaker for each module for branch circuit over-current protection and a phase monitor wired back to the primary module for protection against low voltage, phase imbalance, phase loss, and phase reversal.

F. Compressors: Single circuit with two hermetically sealed vapor injected scroll compressors in a tandem compressor set. Each compressor shall be furnished with a crankcase heater, oil level sight glass, suction gas-cooled motor with solid-state sensors in the windings for overload protection, and in-line circuit breaker. Compressors shall be mounted to the steel frame with rubber-in-shear isolators. Liquid injected scroll compressors are not acceptable. The vapor injection scroll compressors are used with an economized vapor compression cycle offering more heat delivered and a better COP than with a conventional cycle. The cooling provided by inter-stage injection allows the operation of the compressor over a larger operating envelope providing higher heat delivery temperatures at low evaporating temperatures and resulting in larger heating capacities and higher efficiency.

G. Heat Exchangers: Single circuit, cold and hot fluid brazed plate heat evaporator and condenser in each multi-pipe module. Each is constructed of 316 stainless steel plates and copper brazing and shall be insulated with ¾" closed cell insulation. The supply and return fluid piping connections to each heat exchanger shall include an electronic and manual isolation valve to allow servicing of each module individually while the remaining modules continue to operate and to allow for variable flow. The fluid connections to each heat exchanger shall use roll grooved couplings for service convenience and ease of installation.

H. Electronic control valves: Each module's brazed plate heat exchangers branch line shall include an electronic isolation valve that allows system flow to the active modules

H. Electronic control valves: Each module's brazed plate heat exchangers branch line shall include an electronic isolation valve that allows system flow to the active modules to match the cooling or heating requirements to the system load. The valves shall have a minimum opening cycle time of not less than 30 seconds between the fully closed and open position. The valves shall have a minimum close off pressure of 75 psi and a maximum working pressure of 300 psi.

I. Filters: A 40-mesh industrial grade filter strainer shall be factory installed between the header system and each brazed plate heat exchanger inlet. The strainer shall be serviceable by closing the electronic and manual valves to remove each strainer for cleaning without shutting down fluid flow or power to the entire system and allowing nemathe remaining modules to continue to operate. In-line strainers that require complete system shutdown for service and isolation are not acceptable.

J. Air Coil Fan Motors: The air coil fan motors shall be variable speed, maintenance free, and highly efficient Electronically Commutated Motors (ECM) with energy reduction capabilities.

K. Air Coil: Aluminum fins mechanically bonded to coppers tubes with integral subcooling circuits. Fin spacing shall not exceed 16 fins per inch. The air coil shall function as an evaporator or condenser depending on the operational mode.

L. Drain Pan: Factory-provided drain pans underneath the air coils shall be provided to divert water away from the modules during heating mode while in the defrost cycle.

M. Expansion Valves: Each module will have 4 expansion valves; one for defrost, one for cooling mode, and two for heating mode with one on each air coil.

N. Ball Valve: Each module shall contain a refrigeration actuated ball valve to allow for operation in either heating mode, cooling mode, simultaneous heating and cooling mode, and defrost mode.

O. Refrigerant piping: Piping shall be Type K seamless copper, shall have ¾" closed cell insulation on all piping except liquid line, solenoid valves for compressor pumpdown, and Schrader service valves in the suction, discharge, and liquid lines. Each module shall contain a single refrigeration circuit.

P. Fluid Piping: The fluid piping shall be Schedule 10 steel and have ¾" closed cell insulation to maintain fluid temperature. Each module shall have service valves for the independent isolation of each heat exchanger, without affecting the fluid flow to the remaining modules. Each module shall connect to the adjacent module using roll grooved steel couplings and neoprene gaskets. Any type of module-to-module connection external to the modules is unacceptable.

Q. Flow switches: Factory installed and tested thermal dispersion flow sensor on each brazed plate heat exchanger

R. Refrigerant: R-454B. Classified as Safety Group A2L according to ASHRAE 34

2.2 CONTROLS

A. Controls: The primary multi-pipe module shall incorporate the primary microprocessor controller. The primary microprocessor shall communicate with the remaining secondary microprocessors in each module via a local network communications protocol. The primary microprocessor shall include a phase monitor to protect against low voltage, phase unbalance, phase loss, and phase reversal conditions. The primary controller shall read all analog and fault port values from all secondary module controllers.

B. Each multi-pipe control system shall include operational switches for each compressor; high and low pressure transmitters to provide indication of refrigeration pressures; high and low refrigeration pressure alarms that shut down the responsible compressor(s); anti-short cycling compressor timers; minimum compressor run timers; and connection to Building Automation System.

C. Programmable Logic Controller (PLC)

The PLC shall provide the following minimum functions and alarms:

1. Adjustable fluid temperature set point.
2. Multiple stage compressor control, including compressor rotation to provide equal compressor run time.
3. Reset temperature control set point based on decreased load.
4. High and low fluid temperature alarm set points.
5. Fluid inlet and outlet temperature
6. Suction and discharge refrigeration pressures
7. Compressor run status.
8. Current alarm status
9. Demand load
10. Compressor run hours.
11. Number of compressors starts.
12. Alarm logging of previous 2000 alarms with time and date of each occurrence
13. Remote start/stop input.
14. Dry contact for general alarm
15. ‘Smart’ compressor demand distribution algorithm across chiller bank, which seamlessly allows unavailable modules to be placed out of sequence and available modules to be placed back in sequence.
16. BMS interface with the automatic variable flow control
17. Minimum flow control for fluid loops even with no compressors running.
18. ‘Smart’ compressor rotation algorithm within a module which accounts for compressor availability and safety timers.
19. Stand-alone fail-safe mode for each module should Primary module fail, allowing the chiller system to remain operating.
20. Remote hard wired set point capabilities.

D. Interface Panel: A smart operator 7” touch screen interface panel with graphical display shall be installed on the primary module to allow operation and alarm monitoring, adjustment of user set points, and controlled temperatures trending. Primary microprocessor controller provides current alarm status, alarm logging of the previous 2000 alarms, fluid temperatures for each module, refrigeration pressure on each

refrigeration circuit, compressor run hours, current status display, remote on/off, and general alarm contacts.

E. The primary controller shall pass these values to the Building Automation System via BACnet.

F. Defrost Controls: Defrost module delay timer shall allow a maximum of 50% of modules to be in defrost mode simultaneously in order to minimize heating capacity derate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before water chiller installation, examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, and electrical connections to verify actual locations, sizes, and other conditions affecting water chiller performance, maintenance, and operations.

1. Water chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WATER CHILLER INSTALLATION

A. The multi-pipe water chiller system shall be installed in accordance with the Manufacturer’s recommendations where shown on the drawings.

B. Install water chillers on support structure indicated.

C. Equipment Mounting: Install water chiller on concrete bases using elastomeric pads. Comply with requirements in Division 03 Section “Cast-in-Place Concrete.” Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Minimum Deflection: 1/4 inch.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.

F. Install separate devices furnished by manufacturer and not factory installed.

G. Each multi-pipe module is shipped individually for field assembly. Field assembly of system shall consist of the following minimum steps:

1. Manifold fluid piping with factory supplied roll grooved connections. Insulate roll grooved connections after assembly.
2. Connect factory supplied power supply wiring harnesses to the power distribution panel. Install wires to the proper terminals for proper phasing. Unit is wired for A, B, C phase right to left in the load distribution panel. Each wire on the wire harness is identified as to its respective phase.
3. Connect all microprocessors together to form the local communication network. Wiring must be 20-gauge minimum, single twisted pair, shielded wiring.

3.3 PIPING FLUSHING PROCEDURE

A. Prior to connecting the multi–pipe unit to the building fluid loop, the piping shall be flushed with a detergent and hot water (110-130 F) mixture to remove previously accumulated dirt and other organic residue.

B. Prior to flushing, install a 30 mesh or finer Y-type strainer or equivalent in the system piping. During the flushing process, examine and clean the strainer periodically as necessary to remove collected residue. The flushing process shall take not less than 6 hours or until the strainers, when examined after each flushing, are clean. Detergent and acid concentrations shall be used in strict accordance with the respective chemical manufacturer’s instructions. After flushing with detergent and/or dilute acid concentrations, the system loop shall be purged with clean water for at least one hour to ensure that all residual cleaning chemicals have been flushed out.

3.4 CONNECTIONS

A. Comply with requirements in Division 23 Section "Hydronic Piping" Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to chiller to allow service and maintenance.

C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, flexible connector, flow switch, thermometer, plugged tee with pressure gage, and drain connection with valve. Make connections to water chiller with a flange, or mechanical coupling.

D. Connect each drain connection with a union and drain pipe and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection if required.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.

C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
2. Verify that pumps are installed and functional.
3. Verify that thermometers and gages are installed.
4. Operate water chiller for run-in period.
5. Check bearing lubrication and oil levels.
6. Verify proper motor rotation.
7. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
8. Verify and record performance of chilled-water flow and low-temperature interlocks.
9. Verify and record performance of water chiller protection devices.
10. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

D. Prepare a written startup report that records results of tests and inspections.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water chillers.

END OF SECTION

SECTION 237313
MODULAR OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Variable-air-volume, multizone air-handling units.

1.3 SUBMITTALS

A. Product Data: For each air-handling unit indicated.

1. Unit dimensions and weight.
2. Cabinet material, metal thickness, finishes, insulation, and accessories.
3. Fans:

    a. Certified fan-performance curves with system operating conditions indicated.
    b. Certified fan-sound power ratings.
    c. Fan construction and accessories.
    d. Motor ratings, electrical characteristics, and motor accessories.

4. Certified coil-performance ratings with system operating conditions indicated.
5. Dampers, including housings, linkages, and operators.
6. Filters with performance characteristics.
7. Vibration isolation roof curbs with dimensions and weights.

B. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Trane or comparable product by one of the following:

1. Carrier.
2. Daikin.
3. Haakon.
4. Temtrol.
5. Wilsenergy.

2.2 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
2. Casing Joints: Sheet metal screws or pop rivets.
3. Sealing: Seal all joints with water-resistant sealant.
4. Factory Finish for Galvanized-Steel Casings: Apply manufacturer's standard primer immediately after cleaning and pretreating.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

B. Casing Insulation and Adhesive:

1. Materials: ASTM C 1071, Type I.
2. Location and Application: Factory applied with adhesive and mechanical fasteners to the internal surface of section panels downstream from, and including, the cooling-coil section.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service-air velocity.

3. Location and Application: Encased between outside and inside casing.

C. Inspection and Access Panels and Access Doors:

1. Panel and Door Fabrication: Formed and reinforced, double-wall and insulated panels of same materials and thicknesses as casing.
2. Inspection and Access Panels:

a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
b. Gasket: Neoprene, applied around entire perimeters of panel frames.
c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

3. Access Doors:

a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
b. Gasket: Neoprene, applied around entire perimeters of panel frames.
c. Fabricate windows in fan section doors of double-glazed, wire-reinforced safety glass with an air space between panes and sealed with interior and exterior rubber seals.
d. Size: At least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.

4. Locations and Applications:

a. Fan Section: Doors.
b. Access Section: Doors.
c. Coil Section: Doors.
d. Damper Section: Doors.
e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
f. Mixing Section: Doors.

5. Service Light: 100-W vaporproof fixture with switched junction box located inside adjacent to door.

a. Locations: Fan section.

D. Condensate Drain Pans:

1. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and to direct water toward drain connection.

    a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1-2004.
    b. Depth: A minimum of 2 inches deep.

2. Formed sections or Integral part of floor plating.
3. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
4. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

    a. Minimum Connection Size: NPS 1.

5. Pan-Top Surface Coating: Asphaltic waterproofing compound.
6. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

E. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

2.3 FAN, DRIVE, AND MOTOR SECTION

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.

    a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
    b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

B. Centrifugal Fan Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.

1. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
2. Horizontal-Flanged, Split Housing: Bolted construction.
3. Housing for Supply Fan: Attach housing to fan-section casing with metal-edged flexible duct connector.
4. Flexible Connector: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized-steel sheet or 0.032-inch-thick aluminum sheets; select metal compatible with casing.

a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

1) Fabric Minimum Weight: 26 oz./sq. yd.
2) Fabric Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3) Fabric Service Temperature: Minus 40 to plus 200 deg F.

C. Plenum Fan Housings: Steel frame and panel; fabricated without fan scroll and volute housing.

D. Airfoil, Centrifugal Fan Wheels: Smooth-curved inlet flange, backplate, and hollow die-formed airfoil-shaped blades continuously welded at tip flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

E. Fan Shaft Bearings:

1. Prelubricated and Sealed, Ball Bearings: Self-aligning, pillow-block type with a rated life of 250,000 hours according to ABMA 9.

F. Discharge Dampers: Heavy-duty steel assembly with channel frame and sealed ball bearings, and parallel blades constructed of two plates formed around and welded to shaft, with blades linked out of air stream to single control lever.

G. Internal Vibration Isolation and Seismic Control: Fans shall be factory mounted with manufacturer's standard restrained vibration isolation mounting devices having a minimum static deflection of 2 inches.

H. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.
2. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
5. Mount unit-mounted disconnect switches on exterior of unit.

I. Variable Frequency Controllers:

1. See Division 23 “Variable Frequency Drives” for requirements.

2.4 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with ARI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. For multizone units, provide air deflectors and air baffles to balance airflow across coils.
4. Coils shall not act as structural component of unit.

2.5 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.
2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

B. Disposable Panel Filters:

1. Factory-fabricated, viscous-coated, flat-panel type.
2. Thickness: 2 inches.
3. Initial Resistance: 0.3 in. w.g.
4. Recommended Final Resistance: 1.0 in. w.g..
5. MERV (ASHRAE 52.2): 13.
6. Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
7. Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

C. Filter Gage:

1. 3-1/2-inch-diameter, diaphragm-actuated dial in metal case.
2. Vent valves.
3. Black figures on white background.
4. Front recalibration adjustment.
5. 3 percent of full-scale accuracy.
6. Range: 0- to 2.0-inch wg.
7. Accessories: Static-pressure tips with integral compression fittings, 1/4-inch aluminum tubing, and 2- or 3-way vent valves.

2.6 DAMPERS

A. General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm face velocity through damper and 4-inch wg pressure differential.

B. Damper Operators: Comply with requirements in Division 23 Section "Direct Digital Control for HVAC."

C. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with cadmium-plated steel operating rods rotating in stainless-steel sleeve bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 3 cfm/sq. ft. at 1-inch wg and 9 cfm/sq. ft. at 4-inch wg.

D. Mixing Section: Multiple-blade, air-mixer assembly located immediately downstream of mixing section.

2.7 CAPACITIES AND CHARACTERISTICS

A. See plans for capacities and characteristics.

2.8 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

C. Water Coils: Factory tested to 300 psig according to ARI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for hydronic and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting: Install air-handling unit using restrained spring isolators. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Minimum Deflection: 2 inches.
2. Install galvanized-steel plate to equally distribute weight over elastomeric pad.

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

D. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air-handling unit to allow service and maintenance.

C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4, ASTM B 88, Type L copper tubing. See plans for termination. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Hot- and Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

F. Connect duct to air-handling units with flexible connections. Comply with requirements in Division 23 Section "Air Duct Accessories."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
6. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
7. Comb coil fins for parallel orientation.
8. Verify that proper thermal-overload protection is installed for electric coils.
9. Install new, clean filters.
10. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION

SECTION 238126
SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ductless single zone split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2016, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IESNA 90.1-2019 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2019, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 COORDINATION

A. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 07 Section "Roof Accessories."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Trane-Mitsubishi or a comparable product by one of the following:

1. Daikin AC.
2. Carrier.

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

A. Cabinet: Heavy duty ABS and high impact polystyrene plastic with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

1. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2016.
2. Drain Pan and Drain Connection: Comply with ASHRAE 62.1-2016.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Fan: Direct drive, centrifugal fan.

D. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

E. Filters: Permanent, cleanable

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS

A. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Twin Rotary.

2. Variable speed inverter driven compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

3. Refrigerant: R-407C or R-410A.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: Permits operation down to 45 deg F.

H. Mounting Base: Polyethylene.

I. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1-2019

2.4 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 23 "Direct Digital Controls for HVAC."

B. 24V Interface Kit for 3rd party thermostat

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

1. Minimum Insulation Thickness: 1/2 inch thick where indoors, 1 inch thick with aluminum jacketing where outdoors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounting compressor-condenser components on equipment supports as detailed on the drawings. Anchor units to supports with removable, cadmium-plated fasteners.

D. Install seismic restraints.

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Ground equipment according to Division 26.

D. Electrical Connections: Comply with requirements in Division 26.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain split system units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 260000
SUMMARY OF ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. In general, the Electrical Work described herein consists of the installation of new electrical, lighting and signal systems equipment. All work shall be completed as directed by the Owner's authorized representative, in accordance with the Contract, Specifications and Construction Documents.

1. General Conditions of Contract

2. Specifications

3. Drawings

B. This Section includes all necessary and required work to complete the construction as indicated in the Drawings, called for by notes or schedules, or specified herein. This work includes the furnishing of all permits, labor, supervision, services, materials, tools, equipment, testing, transportation and miscellaneous expenses, and the performance of all operations necessary to or incidental to completion of lawful and operating electrical power, lighting and signal systems, whether or not specifically mentioned.

C. All work not shown in complete detail shall be installed per the 2022 California Electrical Code and in conformance with the best standard practice for the trade. Any deviation from the approved Drawings shall be submitted in writing to the Engineer and Owner for approval prior to the installation of the work in question.

D. This work shall include, but not necessarily be limited to, the following elements:

1. Demolition and Phasing:

a. Make temporary feeds and connections to areas and equipment to allow phased construction and continuing operation.

2. Building Electrical Service:

a. Provide electrical service to the building through a new medium voltage transformer derived from the campus-wide 4,160-volt primary electrical distribution system, as shown, complete with underground primary medium voltage conduit and cabling, a new medium voltage transformer, transformer pad and grounding facilities, traffic barriers, secondary conduit

with grounded neutral service feeder, new main switchboard and complete electrical distribution system.

3. Electrical Distribution:

   a. Power distribution system, as shown, complete with switchboards, transformers, panelboards, conduits, feeders, pull boxes, fittings and related equipment and equipment pads.

   b. Trenching, conduits and feeders for electrical power.

4. Grounding:

   a. Grounding system including installations of ground rods, ufer grounds, and ground rings, as shown. Connections to water and/or gas piping and building steel.

   b. Provide the following grounding electrodes at the main switchboard located in the electrical yard and at the main distribution panel located within the building. At each location, bond grounding electrodes together to form the grounding electrode system:

      1) Metal underground water pipe in direct contact with the earth for ten feet or more and electrically continuous to the points of connection of the grounding electrode conductor and the bonding conductors.

      2) The metal frame of the building, where effectively grounded.

      3) Concrete encased electrode (Ufer ground) consisting of a minimum of 20 feet of #3/0 bare copper conductor encased by at least 2 inches of concrete, located within and near the bottom of a concrete foundation or footing that is in direct contact with the earth.

      4) Ground rod of copper clad steel, minimum ¾ inch diameter, minimum 10 feet long, driven full length into the earth. If a maximum resistance to ground of 5 ohms cannot be obtained with a single ground rod, provide additional ground rods installed not closer than 6 feet apart until a maximum resistance to ground of 5 ohms is obtained.

   c. Testing of grounding system as outlined in Section 269500.

5. Signal Distribution:

   a. Trenching, conduits and conductors for signal systems.

   b. Building mounted conduits and conductors for signal systems.

   c. Trenching and conduits for control systems as required by Divisions 21-25 Specification Sections.

6. Building Electrical and Mechanical Systems:

   a. Complete system of branch circuit wiring, conduit and distribution equipment for lighting, receptacles and power.

   b. Electrical work associated with mechanical equipment, including conduit, conductor, disconnect switches and motor starters.

c. Connection to all equipment as furnished by other Sections of these Specifications or as listed on Drawings as furnished by Owner.

7. Lighting:

   a. Provide complete lighting system including fixtures, hangers and supports, LED models and LED drivers, and components associated with the lighting control system.

   b. Provide complete Lighting Control System consisting of manual dimming control stations, occupancy sensors, daylight sensors, automated demand response, astronomic time scheduling and other controls shown in Drawings.

8. Telecommunication Distribution System

   a. Provide complete telecommunication system per Division 27 Specification Sections, including IDF racks complete with Category 6 and fiber optic patch panels and required patch cables, Category 6 horizontal cable and jacks, fiber optic cable, jacks and innerduct, access panels, terminal cabinets, conduit, wiring and terminations and testing for the distribution cabling system.

   b. Network switches shall be provided and installed by the Owner's IT department.

   c. Wireless Access Point devices shall be provided and installed by the Owner's IT department.

9. Fire Alarm System:

   a. Provide a complete fire alarm/emergency voice alarm communication system per Specification Section 283100, including fire alarm control panel, cellular and IP digital alarm communicator transmitters, fire alarm booster power supplies, initiation devices, notification appliances, control and monitoring devices, annunciators, access panels, terminal cabinets, conduit, wiring and terminations and equipment for a complete working system.

10. Each system shall be terminated, tested and calibrated by a factory-authorized installer. This same installer shall terminate and test any peripheral equipment required for the operation of the system.

11. Equipment Connections

   a. Provide equipment connections and coordination in accordance with manufacturer's recommendations and product submittals.

   b. Provide equipment connections and disconnect switches as required for the following equipment:

      1) Mechanical equipment.

      2) Foodservice equipment.

      3) Laundry Equipment.

      4) Owner furnished equipment.

E. Products supplied by Owner (or others, as noted) and installed by Contractor under this Section.

1. None.

F. Products supplied by Contractor but not installed under this Section.

1. None.

G. Work specifically **excluded** from this Division.

1. Furnishing of motors.

H. It shall be understood that all existing conduit with its wiring is presently active (hot), in operation with its pertinent equipment.

I. It shall be noted that this construction work will be planned and executed during ongoing operation of the campus facilities. Any modifications to the existing equipment currently in operation shall be done during scheduled shutdowns and coordinated with the Owner's authorized representative and facility operating personnel to assure minimum downtime.

J. In order to avoid disruption to campus facility operations, certain items of work must be completed before other items of work can be started. Contractor shall coordinate with the Owner's authorized representative as to the sequence of construction activities.

K. Furnish, install and connect an underground grounding system, specifically mentioned on drawings as part of this contract, including all necessary materials and connections as required by code and/or as shown on the construction drawing.

L. Furnish, install and connect all above grade grounding materials and make aboveground connections of underground cables to equipment and/or structural steel as shown on the construction drawings and as required by code.

M. Size, furnish, install and connect new conduit, conduit fittings, and seal fittings, expansion fittings and supports. This includes above grade as well as underground.

N. Size, furnish, and install junction, pull and terminal boxes, in accordance with Code requirements and as shown on the construction drawings.

O. Size, furnish and install all supports required for conduit installation, supports required for the installation of the equipment furnished by this Contractor and equipment furnished by others but installed by this Contractor.

P. Size and field cut the openings for conduits passing through building walls and/or floors. Close and seal all openings after conduits have been installed and/or removed. Closing shall be compatible with, or of the same material as wall and/or floor.

Q. Furnish and install permanent "DANGER - HIGH VOLTAGE" warning signs for the outdoor and indoor switchgear, all unit substations, motor control centers, power distribution panels, and on all doors of all electrical equipment rooms, fenced yards, etc.

R. Furnish and install markers indicating voltage levels (e.g., 12.47 KV, 277/480V, 120/208V, etc.) for all of the electrical equipment such as motor control centers, local lighting panels, lighting transformers, power panels, switchboards, etc....

S. Furnish and install new nameplates per specifications on new motor control centers, motors and on all local control stations, control panels, disconnect switches, push button stations, instrument devices, etc.

T. Furnish and install wire tags in accordance with the specifications indicating wire number as shown on electrical schematics, one line, three line diagrams and specifications.

U. Furnish, install and connect all power, control and instrumentation cable, including all necessary cable lugs, connectors and terminations.

V. Perform all testing per the Specifications and report to Owner's field representative in a timely manner so as not to impede the scheduled completion of the Contract.

W. Furnish all material, labor and testing equipment necessary to check out and test the complete power distribution system in strict accordance with specifications. This shall include check out/start up of systems and/or equipment as directed by Owner.

X. Prime paint all uncoated carbon steel items furnished by Contractor.

Y. Energize low voltage services after testing equipment and wiring in accordance with manufacturer instructions and specifications.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION 260000

SECTION 260100
GENERAL CONDITIONS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. The provisions of this Section shall apply to all of the following Sections of Divisions 26-28 of these Specifications and shall be considered a part of these Sections.

1.3 QUALITY ASSURANCE

A. All work and materials shall fully comply with current rules and regulations of all applicable codes. Nothing in these Drawings or Specifications shall be interpreted as to permit any work not in compliance with these codes. Where work is detailed and/or specified to a more restrictive standard or higher requirement, that standard or requirement shall govern such work. Applicable codes include, but are not limited to, the following:

1. California Code of Regulations (CCR)
    a. Title 8, Industrial Relations
    b. Title 17, Public Health
    c. Title 24, Building Standards
2. 2022 California Building Code.
3. 2022 California Fire Code.
4. 2022 California Electrical Code.
5. Local Codes.

B. All electrical components, devices and accessories shall be listed with Underwriters Laboratories, Inc. (or other testing agency acceptable to authorities having jurisdiction), shall meet their requirements, shall bear their label wherever standards have been established and label service is regularly furnished by that agency, and shall be marked for intended use.

1.4 PERMITS, FEES AND TAXES

A. The Contractor shall secure all necessary permits and pay all required fees and taxes. He shall notify the proper authorities and have the work inspected and tested as required by jurisdictional requirements, pay all charges in connection therewith, and shall present to the Owner properly signed certificates of inspection. Acceptance of the work will not be considered until such certificates have been delivered.

B. The Owner shall pay all utility company charges related to the new services.

1.5 TEMPORARY UTILITIES

A. The Contractor shall supply any supplemental temporary facilities required to provide construction power to the site (i.e. transformers, panels, outlet boxes).

1.6 EXISTING CONDITIONS

A. The Contractor shall carefully examine the site and existing buildings, compare them with Drawings and Specifications, and shall have satisfied himself as to the conditions to be encountered during the performance of the work. No subsequent allowance shall be made on his behalf for any additional expense he may incur due to failure or neglect of Contractor to examine site and to include existing conditions in bid.

B. Any work done as an addition, expansion, or remodel of an existing system shall be compatible with that system.

C. The Contractor shall examine all record drawings made available by the Owner to locate existing underground systems, utilities, conduits, and pipes prior to installing the electrical distribution system. The Contractor shall also examine the site for possible locations of sprinkler pipes. Any damage done to the existing systems during the course of the electrical work, whose locations could be reasonably determined, shall be repaired to the satisfaction of the Owner and the utility or agency involved, at the expense of the Contractor.

1.7 CONDUCT OF THE WORK

A. The Contractor shall maintain on the job a competent foreman or a superintendent at all times to superintend the Work.

1.8 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

A. The Engineer’s decision will be final on interpretation of the Drawings and Specifications. Whenever the words “AS MAY BE DIRECTED”, “SUITABLE”, or “APPROVED EQUAL”, or other words of similar intent and meaning are used, implying that judgment is to be exercised, it is understood that it is in reference to the judgement of the Engineer.

1.9 SUBMITTALS

A. See Specification Section 013300, SUBMITTAL PROCEDURES, for additional information and requirements.

B. Shop Drawings and Product Data

1. In addition to the provisions of Specification Section 013300, SUBMITTAL PROCEDURES, all **Shop Drawings and Product Data** shall comply with the following requirements:

a. The Contractor shall submit for review, complete sets of Shop Drawings and Product Data brochures for materials and equipment as required by each section of the Specifications.

b. All Shop Drawings and Product Data shall be submitted at one time in a neat and orderly fashion in a suitable binder with a Title Sheet including Project, Engineer and Contractor, Table of Contents, and indexed tabs dividing each group of materials or item of equipment. The Specification paragraph number for which they are proposed shall identify all items. The mark number as indicated on Drawings shall also identify all equipment and fixtures.

c. Shop Drawings and Product Data submittal shall include manufacturer's name and catalog numbers, dimensions, loads, and all other characteristics and accessories as listed in the Specifications or on the Drawings. All loads, characteristics, and accessories called for in the Specifications or on the Drawings shall be highlighted, circled or underlined on the Shop Drawings and Product Data. Descriptive literature shall be current factory brochures and submittal sheets.

d. FAX submittals are not acceptable.

e. Material or equipment shall not be ordered or installed until the Engineer processes the written review. Any item omitted from the submittal shall be provided as specified without substitution.

f. Prior to submission of the Shop Drawings and Project Data, Contractor shall review and certify that they meet the requirements of the Contract Documents.

g. A minimum period of two weeks, exclusive of transmittal time, will be required each time Shop Drawings and/or Product Data are submitted or resubmitted for review. The Contractor shall consider this time when scheduling a submittal date.

C. Submittal Review

1. Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the Drawings and Specifications.

2. The Contractor shall agree that Shop Drawings and Product Data submittals processed by the Engineer are not Change Orders and that the purpose of Shop

Drawings and Product Data submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept. The Contractor demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.

3. It shall be clearly understood that the noting of some errors, but the overlooking of others, **does not** grant the Contractor permission to proceed in error or in conflict with Contract Documents. The Contractor shall agree that if deviations, discrepancies or conflicts between Shop Drawings and Design Drawings and Specifications are discovered either prior to or after Shop Drawing submittals are processed by the Engineer, the Design Drawings and Specifications shall control and shall be followed.

4. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

D. Substitutions

1. See Specification Section 012500, SUBSTITUTION PROCEDURES, for additional information and requirements.

2. In addition to the provisions of Specification Section 012500, SUBSTITUTION PROCEDURES, **Substitutions** shall comply with the following requirements:

a. Manufacturers, model numbers and other pertinent information listed in the Specifications or on the Drawings are intended to establish minimum standards of performance, function and quality. Unless otherwise noted, the Contractor may submit equivalent compatible UL-listed equipment from other manufacturers for review, as long as the minimum standards are met.

b. Calculations and other detailed data indicating how the item was selected shall be included for items that are not specified. Data must be complete enough to permit detailed comparison of every significant feature, function, performance, and quality characteristic that is specified, scheduled or detailed. The comparison must prove that the substituted item equals or exceeds the requirements of the specified item.

c. The Contractor shall assume full responsibility that substituted items or procedures will meet the Specification and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.

d. At the Engineer's request, the Contractor shall furnish locations where equipment similar to the substituted equipment is installed and operating along with the user's phone numbers and contact person. Satisfactory operation and service history will be considered in the acceptance or rejection of the proposed substitution.

E. Record Drawings

1. See Specification Section 017839, PROJECT RECORD DOCUMENTS, for additional information and requirements.

2. In addition to the provisions of Specification Section 017839, PROJECT RECORD DOCUMENTS, **Record Drawings** shall comply with the following requirements:

   a. At the beginning of the Project, one print of each applicable Drawing will be issued to the Contractor specifically for use in preparing Record Drawings. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the Drawings. Final locations of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, e.g. building, curbs, walks. The original Drawings will be made available to the Contractor, from which he shall have made, a set of reproducible Drawings. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible Drawings. The Record Drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review, after first securing the Inspector's verification by signature.

F. Operations and Maintenance Instructions

1. See Specification Section 017823, OPERATION AND MAINTENANCE DATA, for additional information and requirements.

2. In addition to the provisions of Specification Section 017823, OPERATION AND MAINTENANCE DATA **Operations and Maintenance Instructions** shall comply with the following requirements:

   a. Three copies of Operation and Maintenance Instructions and Wiring Diagrams for all equipment shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. UPS-1). All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation.

   b. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. MCC, UPS, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included.

   c. The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The Engineer's office shall be notified 48 hours prior to this meeting.

   d. The Contractor shall prepare a letter indicating that all Operation and Maintenance Instructions (printed and verbal) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.10 COORDINATION

A. See Specification Section 013113, PROJECT MANAGEMENT AND COORDINATION, for additional information and requirements.

B. Electrical Drawings are essentially diagrammatic, unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, conduits, fixtures, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interferences with each other, or with architectural, civil, mechanical, plumbing, structural or other elements.

C. While the size and location of equipment are shown to scale wherever possible, all dimensions and conduit/conductor data shall be verified in the field.

D. Where the work requires connections to be made to equipment furnished and set in place by others, the Contractor shall obtain exact rough-in dimensions from the manufacturer of such equipment and he shall install the connections in a neat and workmanlike manner.

E. If discrepancies are discovered between Drawings and Specifications requirements, the more stringent requirement shall apply.

F. All conflicts shall be called to the attention of the Architect and the Engineer prior to the installation of any work or the ordering of any equipment.

G. No work shall be prefabricated or installed prior to this coordination. No additional compensation will be considered to the Contractor for any prefabrication or installation performed prior to this coordination.

1.11 SCHEDULING

A. All work shall be scheduled subject to the review of the Architect, Engineer and the Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work for which contracted, as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner.

1.12 WARRANTY

A. See Specification Section 017836, WARRANTIES, for additional information and requirements.

B. Guarantee shall be in accordance with the General Conditions. These Specifications may extend the period of the guarantee for certain items. Where such extension are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

C. Contractor shall deliver to the Owner a written guarantee on all workmanship, materials and equipment for a period of one (1) year from the date of acceptance by the Owner. Any work found to be faulty during that period of time shall be corrected at once, upon written notification, at the expense of the Contractor. This shall include repair or

replacement of the premises that may be damaged as a result of faulty work and materials furnished.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new unless otherwise noted.

B. Materials and equipment of a given type shall be by the same manufacturer.

C. Materials and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance. Upon completion of work and prior to final inspection, Contractor shall thoroughly clean all exposed fixtures, trim and equipment, and shall leave the entire installation in neat, clean, and useable condition. Materials and equipment shall be free of dents, scratches, marks, shipping tags, and all defacing features at time of project acceptance.

D. The Contractor shall order materials and equipment in a timely manner to prevent any delay in the construction schedule, and he shall bear any penalty by vendors to meet schedules.

E. Verify all dimensional information to ensure proper clearance for installation of equipment. Check all materials and equipment after arrival on the jobsite and verify compliance with the Contract Documents.

PART 3 - EXECUTION

3.1 DEMOLITION

A. The Contractor shall protect existing electrical equipment and installations that are not indicated to be removed. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Exposed electrical equipment and installations, indicated to be demolished, shall be removed in their entirety.

C. Buried raceway and wiring, indicated to be abandoned in place, shall be cut 2 inches below the surface of adjacent construction and removed in its entirety. Raceways abandoned in place shall be capped and disturbed surfaces shall be patched to match existing finish.

D. Demolished material shall be removed from Project site.

E. Components indicated for relocation shall be removed, stored, cleaned, reinstalled, reconnected, and made operational.

3.2 CUTTING AND PATCHING

A. The Contractor shall perform all cutting and drilling, or other work, required to provide openings in walls, ceilings, floors, footings, foundations or other structures necessary to accomplish work under this Specification Division. The cutting shall be performed by skilled mechanics of the trades involved.

B. Cutting or coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Architect.

C. Wherever possible, work shall be done in a concealed and neat workmanlike manner requiring the least amount of cutting of studs, plates and woodwork. Such cutting or notching is allowed only after consultation with and by permission of the Engineer.

D. The Contractor shall repair and refinish disturbed finish materials and other surfaces to accurately match adjacent undisturbed new or existing structures and surfaces and shall install new fireproofing where existing fire-stopping has been disturbed. The repair and refinishing of materials and other surfaces shall be by skilled mechanics of the trades involved.

E. All cuts are to be clean with no chipping. Where chipping occurs as a result of work in a cut area, a new clean cut shall be made immediately prior to patching.

3.3 EXCAVATION AND BACKFILL

A. The Contractor shall provide excavation and backfilling required to complete work detailed in the Drawings and Specifications. Unless otherwise noted, minimum earth cover above top of conduit outside building walls shall be 24", not including base and paving in paved areas.

B. The location of all underground facilities shall be verified with the Owner and utility companies prior to the commencement of any excavation.

C. The Contractor shall contact Underground Service Alert (USA), at 1-800-642-2444, ten (10) days prior to doing any excavation or trenching, and shall advise USA of the work schedule and comply with their requirements.

D. The Contractor shall notify the Owner 72 hours prior to any excavation.

E. Provide all shoring required by site conditions. Where over-excavation occurs, provide compacted sand backfill. Where groundwater is encountered, remove to keep excavation dry, using well points and pumps as required.

F. The conduit shall be laid on firm soil cut true and even to afford bearing for the full length of the barrel of the conduit.

G. When the bottom uncovered at sub-grade is soft and, in the opinion of the Engineer, cannot support the conduit, a further depth shall be excavated and refilled to conduit foundation grade as required by the Engineer.

H. Backfill (where concrete encasement is not required):

1. Material 3” below, 3” around, and to 6” above conduit shall be sand. Place carefully around and on top of conduit, taking care not to disturb conduit. Consolidate with vibrator.

2. Material from 6” Above Conduit to Grade shall be sandy or silty loam, free of lumps, laid in 6” layers, uniformly mixed to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6” layers may be used, subject to review by Engineer.

I. No excavation below the level of, or adjacent to, foundations of footings shall be made except in a manner approved by the Structural Engineer.

J. Compaction

1. Prior to compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Under **Structures, Building Slabs, Walkways, and Steps**, compact top 6” of sub-grade and each layer of backfill or fill material at 92% maximum relative compaction. Compact upper 2’ of backfill in utility trenches or other excavations to 92% minimum relative compaction.

3. In **Lawns and Unpaved Areas**, compact top 6” of sub-grade material to 85% relative compaction.

4. Under **Pavement**, compact top 8” of sub-grade immediately beneath the base course at 95% minimum relative compaction.

3.4 CONCRETE EQUIPMENT BASES

A. The Contractor shall provide a concrete equipment base for each piece of electrical equipment required to have a base as shown in the Drawings, Notes and Details.

B. Concrete equipment bases shall be 6” high concrete, 3500PSI strength, unless otherwise noted. Base shall extend 6” beyond the largest dimensions of the equipment, unless otherwise noted. The top edge of the base shall have a ¾” chamfer. The base shall have #4 reinforcing bars at 12” on center, each way, located at the mid-depth of the base.

C. If the base is not poured at the same time as the floor slab with base rebar tied to floor rebar, the base shall be anchored to the floor slab per the following criteria:

1. Drill 1” diameter, 4” deep hole in floor.

2. Fill hole with **Simpson SET Epoxy** then insert 8” long, #4 rebar into hole. Tie this rebar to that required for the equipment base.

3. Provide a minimum of 4 of these anchors per base but no more than 4 feet apart in either direction.

4. Anchor points shall be 12” from the edge of the base.

D. Concrete anchors shall be steel bolts with expansion anchors requiring a drilled hole. Powder-driven anchors are not acceptable. Minimum concrete embedment shall be 4.5 diameters but not less than manufacturer’s requirements for minimum strength. Minimum spacing shall be 10 diameters center-to-center and 5 diameters center to edge of concrete but not less than manufacturer’s requirements for minimum strength. Maximum allowable stresses for tension and shear shall be 80% of the ICC-ES test report values.

E. Where applicable, concrete structures shall be submitted to the serving utility for their approval prior to installation.

F. Concrete bases for pole mounted lighting fixtures shall be 3500PSI strength, unless otherwise noted, and shall have vertical reinforcing bars with horizontal reinforcing bar ties as detailed on the drawings. The top edge of the concrete base shall have a 1” chamfer.

3.5 SEISMIC ANCHORAGE AND BRACING

A. Equipment Anchorage

1. All electrical equipment and components shall be anchored and installed per the details on the DSA approved construction documents. Where all equipment shall be securely anchored or braced to meet the force and displacements requirements prescribed in the 2022 CBC, Sections 1617A.1.18 through 1617A.1.26. and ASCE 7-16 Chapter 13, 26, and 30:

   a. All permanent equipment and components

   b. Temporary or movable equipment that is permanently attached (e.g. hard wired) to building utility electrical service.

   c. Movable equipment which is stationed in one place for more than 8 hours and heavier than 400 pounds are required to be anchored with temporary attachments.

2. The attachment of the following electrical components shall be positively attached to the structure, but need not be detailed on the plans. These components shall have flexible connections provided between the components and associated conduit.

   a. Components weighting less than 400 pounds and have a center of mass located 4 feet or less above the adjacent floor or roof level that directly support the components.

   b. Components weighting less than 20 pounds, or in the case of distributed systems, less than 5 pounds per foot, which are suspended from a roof or floor or hung from a wall.

1) For those elements that do not require details on the approved drawings, the installation shall be subject to the approval of the Structural Engineer of Record and the DSA Structural Engineer. The project inspector will verify that all components and equipment have been anchored in accordance with above requirements.

B. Electrical Distribution System Bracing

1. Electrical distribution systems shall be braced to comply with the forces and displacements prescribed in ASCE 7-16 Section 13.3 as defined in ASCE 7-16 Section 13.6.7, 13.6.6, 13.6.5, and 2022 CBC, Sections 1617A.1.23, 1617A.1.24, 1617A.1.25, and 1617A.1.26.

2. The bracing and attachments to the structure shall be detailed on the approved drawings or they shall comply with one of the OSHPD Pre-Approvals (OPM#) as modified to satisfy anchorage requirements of ACI 318, Chapter 17.

3. Copies of the manual shall be available on the jobsite prior to the start of hanging and bracing of the electrical distribution systems.

4. The Structural Engineer of Record shall verify the adequacy of the structure to support the hanger and brace loads.

3.6 CLEANING AND PROTECTION

A. The Contractor shall, progressively and at completion of the job, thoroughly clean all of his work including outlets, fittings, and devices, and inspect exposed finishes. The Contractor shall remove all burrs, dirt, grease, paint spots, stains, labels, tags, rust, foreign material, and construction debris resulting from his work.

B. The Contractor shall protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 260100

SECTION 260500
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. See Section 260000

1.3 STANDARDS

A. NEMA 250 Standard for Enclosures for Electrical Equipment (1000 Volts Maximum)

PART 2 - PRODUCTS

2.1 CONCRETE PADS, PULL BOXES AND MANHOLES

A. At the Contractor's option, he shall provide cast-in-place or pre-cast structures.

B. Concrete Forms and Reinforcement Materials shall be as specified in Division 03 Section "Cast-in-Place Concrete".

C. Concrete shall be 3500-psi, 28-day compressive strength as specified in Division 03 Section "Cast-in-Place concrete".

D. Weatherproof concrete pull boxes, junction boxes and telephone boxes shall be manufactured by Christy Concrete Products or equal. All boxes shall have lids marked "Power", "Signal", "Fiber Optic", "Danger-High Voltage", etc. and be traffic-rated per CalTrans drawing ES-8 minimum where pull box occurs in vehicular traffic areas.

2.2 RACEWAYS AND FITTINGS

A. Galvanized rigid steel conduit (GRC) shall meet ANSI C80.1, and be heavy wall, hot dipped galvanized inside and out, with threaded ends, for use with threaded type fittings.

B. Galvanized intermediate metallic conduit (IMC) shall meet ANSI C80.6, be zinc-coated steel and have threaded fittings.

C. Galvanized electrical metallic tubing (EMT) shall meet ANSI C80.3, and be continuous, seamless steel tubing, galvanized or sherardized on exterior, coated on interior with smooth hard finish of lacquer, varnish or enamel, with steel set-screw, steel compression or die-cast compression type fittings. Provide concrete-tight type compression fittings where required and rain-tight wet location listed compression fittings for outdoor locations.

D. Rigid non-metallic conduit (RNC) shall meet NEMA TC 2, be Schedule 40 PVC, suitable for 90°C, with solvent cemented type NEMA TC3 fittings.

E. Flexible metallic conduit (FMC) shall be single strip, continuous, flexible interlocked double-wrapped steel, hot dip galvanized inside and out forming smooth internal wiring channel, with steel, compression type fittings.

F. Liquid-tight flexible metallic conduit (LFMC) shall be same as FMC except with inert sunlight-resistant, mineral-oil-resistant watertight plastic outer jacket. Fittings shall be cast malleable iron body and gland nut, cadmium plated with one-piece brass grounding bushings threaded to interior of conduit. Spiral molded vinyl-sealing ring between gland nut and bushing and nylon-insulated throat.

G. All raceway fittings shall be specifically designed for the raceway type with which used.

2.3 METAL CLAD CABLE (TYPE MC-PCS)

A. Type MC-PCS Cable shall consist of 3 or more individually insulated 600V THHN/THWN copper conductors not less than #12 AWG + 2 additional insulated 600V THHN/THWN #16 AWG copper conductors separately contained within a PVC jacket. All conductors shall be contained within an overall polypropylene cable assembly tape and an outer galvanized steel or aluminum interlocked armor.

B. Type MC-PCS Cable shall have as one of its conductors a separate full sized equipment grounding conductor as the armor is not considered an equipment grounding means.

C. Type MC-PCS Cable fittings shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Fittings shall be UL listed for use with MC cable type specified.

2.4 CONDUCTORS

A. All conductors shall be delivered to the site in their original unbroken packages, plainly marked or tagged with UL labels, size, type of wire, type of insulation, name of the manufacturing company and trade name of the wire.

B. All conductors shall be minimum of 98% conductivity soft drawn copper. Conductors #8 AWG and larger shall be stranded type “THHN/THWN”, 600 Volt insulation.

Conductors #10 AWG and smaller shall be solid copper “THHN/THWN”, 600 Volt insulation.

C. Insulation shall be Thermoplastic Type rated at 75 degrees C. minimum.

2.5 PULL BOXES AND WIREWAYS

A. Pullboxes and Enclosures for outdoor use shall be NEMA 250, Type 3R or Type 4, unless otherwise noted.

B. Pullboxes and Enclosures for indoor use shall be NEMA 250, Type 1, unless otherwise noted.

C. Wireways shall be constructed in accordance with UL 870 for wireways, auxiliary gutters and associated fittings. Every component including lengths, connectors and fittings shall be UL Listed.

D. Wireways and auxiliary gutters shall have continuous removable cover secured with screws and keyhole slots. Hinged cover shall be provided where installed above suspended ceiling.

E. Fabricated sheet steel pull boxes shall be installed only in dry, protected locations and shall be furnished with knockouts and removable screw cover. Box shall be finished with one coat of zinc chromate and a coat of primer sealer and where exposed to public view shall be painted to match the surrounding surface.

F. Weatherproof sheet steel pull boxes shall be fabricated of code gauge galvanized sheet steel with two coats of rust resistant finish and shall be furnished with gasket and made completely weathertight.

2.6 WIRING DEVICES AND MATERIALS

A. Outlet Boxes shall meet NEMA OS1 and be galvanized code gauge steel. Boxes in masonry shall be square cornered. Boxes exposed to weather or in wet locations shall be Type FD cast metal with external threaded hubs and gasketed cover and shall meet NEMA FB1.

B. Outlet box extensions shall be U.L. listed and shall be attached to box with threaded metal screws. Provide Arlington Industries “Flash Guards” where outlet boxes are installed in wood finish materials.

C. Approved manufacturers of metal boxes are Circle AW, Crouse-Hinds, Steel City or equal.

D. Floor Boxes and Fittings

1. First Floor Slab On-Grade Applications:

a. Floor boxes installed in the first floor concrete slab on-grade shall be provided with a concrete pour pan and shall have a thickened slab beneath the floor box.

b. Single service power floor boxes shall be cast iron, recessed flush, floor boxes for installation in slab-on grade. Single service power floor boxes shall be Legrand Omnibox series one and two gang boxes, or equivalent, as indicated on the Drawings.

c. Combination power and data floor boxes shall be Legrand evolution series six-gang, or equivalent, rated for slab on-grade installation.

d. Provide floor boxes complete with device plates, outlet devices, coverplates and combination carpet and tile flanges.

2. Second Floor Slab Above-Grade Applications:

a. Single service power or data floor boxes shall be cast, recessed flush, floor boxes for installation in second floor slab-above grade. Second floor floor boxes shall be Legrand Omnibox series one and two gang boxes, or equivalent, as indicated on the Drawings.

b. Second floor recessed flush slab-above-grade floor boxes shall not exceed 3.38” in height and shall have conduit entry hubs on four sides.

c. Provide floor boxes complete with device plates, outlet devices, coverplates and combination carpet and tile flanges.

E. A/C Snap Switches:

1. 120/277 Volt Switches shall be quiet, fast make, fast break design, toggle handle, with totally enclosed case, rated 20 ampere, heavy duty specification grade. Provide matching two pole, 3-way, 4-way, and key switches as required.

2. A/C snap switches served by emergency power circuits shall be red.

3. A/C snap switches shall be Hubbell or Leviton 1221 series.

F. Receptacles:

1. Duplex Receptacles:

a. Duplex Receptacles shall be tamper-resistant, full gang size, polarized duplex, parallel blade, U-grounding slot, specification grade, rated at 20 amperes, 125 volts and designed for split feed service.

b. Receptacles served by normal power circuits shall be ivory, grey, white or brown, dependent upon room wall finish and as direct by Architect. Receptacles served by emergency power circuits shall be red.

c. Duplex receptacles shall be Hubbell HBL5362WTR series, or equivalent.

2. GFCI Receptacles:

a. GFCI receptacles shall be weather-resistant, tamper-resistant, duplex, feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on

same circuit. Units shall be designed for installation in a 2-3/4-inch deep outlet box without an adapter.

b. Duplex GFCI receptacles shall be Hubbell #GFTWRST20W series, or equivalent to match regular duplex receptacles.

3. TVSS Receptacles:

a. TVSS Receptacles shall be Decora Plus duplex, straight blade, industrial grade, self-grounding, surge protected with indicator light, rated at 20 amperes, 125-volts.

b. TVSS Receptacles shall have integral TVSS with line-to-ground, line-to-neutral, and neutral-to-ground surge protection, with a nominal clamp level rating of 500 volts and minimum single transient pulse energy dissipation of 140 J line to neutral, and 70 J line to ground and neutral to ground.

c. TVSS Receptacles shall be Hubbell HBL5362WSA series, or equivalent.

4. Required California Energy Code Controlled Receptacles: Provide one controlled duplex receptacle within 6-feet of each uncontrolled receptacle in all private offices, open office areas, reception lobbies, conference rooms, kitchenettes in office spaces and copy rooms as required by 2022 California Energy Code Section 130.5(d). Controlled receptacles shall be permanently factory marked with the symbol shown in 2022 CEC Figure 406.3(E) and the word “controlled”. Adhesive labels shall not be permitted in lieu of permanent factory marking. Controlled receptacles shall be tamper-resistant Hubbell HBL5362C2WHITR series or equivalent.

5. Required Weather-Resistant Receptacles: All 15- and 20-ampere, 125- and 250-volt non-locking type receptacles located outdoors and in damp and wet locations shall be listed weather-resistant type.

6. Required Tamper-Resistant Receptacles: Tamper resistant receptacles shall be provided in the following areas where required by CEC 406.12:

a. Child care facilities;

b. Preschool and elementary school education facilities;

c. Business offices, corridors, waiting rooms and the like in clinics, medical and dental offices and outpatient facilities;

d. Subset of assembly occupancies described in CEC 518.2 to include places of waiting transportation, gymnasiums, skating rinks and auditoriums;

7. Receptacles for Owner-furnished equipment shall match that equipment’s plug configuration.

8. Other Receptacles: Other receptacles shall match the plug configuration and ratings required for the utilization equipment that is served.

G. Device cover plates shall be provided and installed at all wiring devices, switches, outlets, and similar applications, and shall be as directed by architect. Pull boxes and junction boxes to which no fixture is to be attached shall be fitted with blank cover plates painted to match surrounding. All cover plates installed on rated walls shall be

brushed stainless steel. Cover plates for receptacles in wet locations shall have an enclosure that is weatherproof whether or not the attachment plug cap is inserted and shall be identified as “extra-duty”. Cover plates installed at switches used for lighting control in all multiple occupant restrooms, all hallways and corridors, and in other locations where lockable cover plates are indicated on the Drawings shall be the dustproof locking stainless steel cover Legrand model WP26-L.

2.7 TERMINAL CABINETS AND CLOSETS

A. Cabinets and fronts shall be in accordance with NEMA Standard Publication No. PB1-1971 and UL Standards No. 67. Fronts shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring loaded door pulls. The flush lock shall not protrude beyond the front of the door. All locks shall be keyed like the panel board locks. Fronts shall have adjustable indicating trim clamps that shall be completely concealed when the doors are closed. Doors shall be mounted by completely concealed steel hinges. Fronts shall not be removable with the door in the locked position. A frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge full finished steel with rust inhibiting primer and baked enamel finish.

2.8 PANELBOARDS

A. Furnish panelboards shown on plans and described herein. All cans shall be a minimum of 20” wide and 5.75” deep unless otherwise shown. They shall be totally flat or equal with flush keyed locks.

B. Fronts shall be cold rolled sheet steel painted with ANSI 61 gray enamel over a rust inhibitor. They shall be equipped with door, flush hinges, and flush proper cylinder tumbler lock, metal circuit card holder, and quarter turn adjustable trim clamps. Panel locks shall be keyed alike.

C. Panel shall consist of reinforced corrosion resistant galvanized sheet steel frame with silver plated copper bus bars and circuit breakers properly supported to prevent vibration breakage in handling. All terminals shall be solderless type suitable for specified conductors of size indicated.

D. Neutral bus shall be full size. Neutral bus shall be 200% rated when supplied from a double neutral feeder. Provide an equipment ground bus in each panelboard. In addition to the equipment ground bus, provide an isolated ground bus when supplied from a feeder which includes an isolated grounding conductor.

E. Branch circuit breakers shall be molded case, bolt-on, and fully interchangeable without disturbing adjacent units. All 2-pole and 3-pole breakers shall have common trips. Circuit breakers supplying Class 1 transformers shall be lockable in the off position.

F. Branch panelboards and overcurrent protection devices shall have a minimum short circuit rating of no less than 10,000 RMS symmetrical AIC (120/208V).

G. Distribution panelboards and overcurrent protection devices shall have a minimum short circuit rating of no less than 42,000 RMS symmetrical AIC (120/208V).

H. All Panelboards shall be fully rated as shown on Drawings; series-rating shall not be allowed.

I. Panelboards shall bear an Arc-Flash Hazard Warning label in accordance with CEC Article 110.16.

J. Breakers for switching lights shall be type SWD, rated for switching duty. Breakers for mechanical equipment shall be HACR type.

K. All spaces shall have hardware.

2.9 DISCONNECTING DEVICES

A. Disconnecting devices shall be provided as shown and/or as required by CEC.

B. Motor-rated switches shall be toggle-type, quick make-quick break, rated 2 HP, 250 VAC, with number of poles as required. They shall be equipped with overload heaters rated for overload protection of loads controlled.

C. Motor-rated switches shall be flush-mounted adjacent to load controlled. Where flush mounting is not possible, switches shall be surface mounted in NEMA enclosure suitable for environment in which installed.

D. Disconnect switches shall be 250V or 600V class, rated heavy-duty, horsepower rated, quick-make, quick-break, dead-front type and provided with proper number of poles.

E. Disconnect Switches shall be self contained in a NEMA 1 gasketed enclosure (NEMA 3R where installed outdoors) and externally operable from the front.

F. Fusible disconnect switches shall be equipped with rejection type clips suitable for UL Class R fuses up to 600A and suitable for UL Class L fuses above 600A. Fuse interrupting rating shall be 200,000 RMS symmetrical amperes.

G. Circuit breakers utilized as disconnecting devices shall comply with the requirements stated in other articles of this section and CEC.

2.10 FUSES

A. Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Bussman
2. Gould Shawmut
3. Littlefuse.

B. Fuses 600 amperes and below shall be UL Class RK1, 200,000 RMS symmetrical amperes interrupting rating.

2.11 INDIVIDUAL MOTOR CONTROLLERS:

A. Individual Motor Controllers shall be self contained in NEMA 1 gasketed enclosure (NEMA 3R where installed outdoors) and externally operable from the front.

B. Individual Motor Controllers shall be full-voltage non-reversing (FVNR) type combination magnetic starters for motors of ½ HP to 60 HP. Individual Motor Controllers shall be reduced voltage, non-reversing, autotransformer type combination magnetic starters for motors 75 HP and larger.

2.12 MAGNETIC STARTERS FOR MECHANICAL EQUIPMENT

A. All magnetic starters for mechanical equipment shall be furnished with integral 120VAC control transformers, sized to handle the starter and all controls connected to it – pilots, EP valves, etc.

B. All magnetic starters for mechanical equipment shall be provided with auxiliary contacts as required for interlock to EMS System. An allowance of at least one auxiliary contact per starter shall be estimated.

2.13 SUPPORTING DEVICES

A. Supporting devices shall be constructed of cold-formed steel, with a corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal items for use outdoors or in damp locations shall be hot-dipped galvanized steel.

C. Slotted-steel channel supports shall have flanged edges turned toward the web, and 9/16-inch diameter slotted holes at a maximum of 2 inches on center, in the web.

1. Channel thickness shall be selected to suit structural loading.

2. Fittings and accessories shall be products of the same manufacturer as the channel supports.

D. Raceway and cable supports shall be manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe sleeves shall be ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, with plain ends.

F. Cable supports for vertical conduit shall be a factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs shall have number and size of conductor gripping holes as required to

suit individual risers. Body shall be constructed of malleable-iron casting with hot-dip galvanized finish.

G. Concrete anchors shall be steel bolts with expansion anchors requiring a drilled hole. Powder driven anchors are not acceptable.

H. Toggle bolts shall be all-steel springhead type.

2.14 ELECTRICAL IDENTIFICATION

A. Identification devices shall be a single type of product for each application category. Colors shall be as prescribed by ANSI A13.1, CEC, and these Specifications.

B. Raceway and cable labels shall comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Pre-tensioned, wraparound plastic sleeves shall be a flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.

2. Preprinted, flexible, self-adhesive, vinyl labels shall have a legend, over-laminated with a clear, weather- and chemical-resistant coating.

3. Color shall be black letters on orange background.

4. Legend shall indicate voltage.

C. Self-adhesive colored marking tape for raceways, wires and cables shall be vinyl tape, not less than 1 inch wide by 3 mils thick.

D. Underground Warning Tape shall be vinyl tape, compounded for permanent direct-burial service, not less than 6 inches wide by 4 mils thick, embedded with a continuous metallic strip or core, brightly-colored, continuously-printed with a legend that indicates the type of underground line.

E. Tape markers for wire shall be vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-coding cable ties shall be made of Type 6/6 nylon, be self-locking type and of colors to suit coding scheme.

G. Engraved plastic labels, signs and instruction plates shall be made from black (or red as noted) Bakelite laminate engraving stock with a white core, punched or drilled for mechanical fasteners. It shall have a minimum thickness of 1/16-inch for signs up to 20 sq. in. and a minimum thickness of 1/8-inch for larger sizes.

H. Interior Warning and Caution signs shall comply with 29 CFR, Chapter XVII, Part 1910.145 and shall be preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution signs shall comply with 29 CFR, Chapter XVII, Part 1910.145 and shall be weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch, galvanized-steel backing, with colors, legend, and size appropriate to the application. They shall be equipped with 1/4-inch grommets in each corner for mounting.

J. Fasteners for nameplates and signs shall be self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

K. Arc-Flash Hazard Warning labels shall be provided at electrical equipment such as switchboards and panelboards in accordance with CEC 110.16.

L. Circuit Identification – A typewritten circuit directory shall be provided at each panelboard and switchboard in accordance with CEC Article 408.4(A). The Contractor shall develop and prepare the circuit identification description based on the as-built condition.

M. Source of Supply Identification – All switchboards, panelboards and transformers shall have a typewritten label applied indicating the device or equipment where the power supply originates per CEC Article 408.4(B).

2.15 TOUCHUP PAINT

A. Touch-up paint shall be equipment manufacturer's paint selected to match installed equipment finish.

B. Touch-up paint on galvanized surfaces shall be zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL INSTALLATION

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site throughout the construction of the project.

B. The layout and installation of electrical work shall be coordinated with the overall construction schedule to prevent delay in completion of the project.

C. Dimensions and information regarding accurate locations of equipment and structural limitations and finish shall be verified with other sections.

D. The drawings do not show all raceway, wiring, offsets, bends, special fittings, junction or pull boxes necessary to meet job conditions. Items not shown as indicated, where

are clearly necessary for proper operation or installation of systems shown, shall be provided as required, at no increase in contract price.

E. Materials and Components shall be installed level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

F. Electrical equipment, outlets, junctions and pull boxes shall be installed in accessible locations, avoiding obstructions, preserving maximum headroom, and keeping openings and passageways clear.

G. Equipment shall be installed to facilitate service, maintenance, and repair or replacement of components. It shall be connected for ease of disconnecting, with minimum interference with other installations. Minor adjustments in the locations of equipment shall be made where necessary providing such adjustments do not adversely affect function of the equipment. Major adjustments for the location of equipment shall be previously approved and detailed on the Record Drawings.

H. Right of Way shall be given to raceways and piping systems installed at a required slope.

3.2 PRECAST CONCRETE PULL BOXES AND MANHOLES

A. Contractor shall provide a minimum of 3-6” of sand base material suitable to receive the pullbox or manhole. The base material shall be compacted and graded level at proper elevation to receive the pullbox or manhole in relation to the conduit grade or ground cover requirements as designated in the plans.

B. Sealants used between the joints of the pullbox or manhole are at the Contractor’s discretion unless otherwise specified. If grout is used, it should consist of two parts plaster sand to one part cement with sufficient water added to make the grout flow under its own weight. The grout should be poured into a water soaked groove and filled to the top of the groove unless a double amount is to be used as a further precaution against leakage. In this case, the mastic sealant should be placed on the two shoulders of the groove. The next section of pullbox or manhole should be placed while the foaming action is in process. Contractor shall verify grades with the Engineer and shall set holes and boxes level at proper grades.

C. All conduits penetrating the pull box or manhole shall have seals to prevent water from entering the raceway.

3.3 RACEWAY APPLICATION

A. Galvanized Rigid Steel Conduit (GRC) **may** be used in all locations. Where installed in direct contact with earth, conduit shall be wrapped with two layers of half-lapped 10-mil PVC tape for a total thickness of 40-mil or have a factory applied 40-mil PVC coating.

B. Galvanized Rigid Steel Conduit (GRC) **shall** be used where exposed to physical damage, indoors where exposed to moisture, in exposed outdoor installations, in systems higher than 600 volts, and where required by code.

C. Galvanized Intermediate Metallic Conduit (IMC) **may** be used in indoor locations not in direct contact with earth.

D. Galvanized Electrical Metallic Tubing (EMT) may be used in dry indoor locations according to the following criteria:

1. It is not subject to physical damage.

2. It is not in direct contact with earth.

3. It is not in concrete slabs.

4. It is not in a hazardous area.

E. Rigid Non-Metallic Conduit (RNC) Schedule 40 PVC **may** be used underground or below concrete slabs on grade. Rigid Non-Metallic Conduit (RNC) Schedule 80 PVC **may** be used to pass through concrete slabs. Rigid Non-Metallic Conduit (RNC) **may** be used in compliance with utility company requirements for utility service conduits. Rigid Non-Metallic Conduit (RNC) **shall not** be installed above grade or above finished floor level.

F. Liquid-tight Flexible Metallic Conduit (LFMC) **may** be used in all locations to make final connections to motors, transformers, or other mechanical equipment (not to exceed 24 inches in length) or lighting fixtures (not to exceed 72 inches in length). Where specifically approved by the Engineer, LFMC may be used to facilitate wiring in tight locations or in other conditions that make the use of other conduit impracticable.

G. Flexible Metallic Conduit (FMC) **may** be used in dry locations to make final connections to motors, transformers, or other mechanical equipment (not to exceed 24 inches in length) or lighting fixtures (not to exceed 72 inches in length). Where specifically approved by the Engineer, FMC may be used to facilitate wiring in tight locations or in other conditions that make the use of other conduit impracticable.

3.4 RACEWAY INSTALLATION

A. General

1. Expansion joints shall be provided at building expansion joints or as required due to length of run or difference in temperatures.

2. All fittings that are exposed or in damp areas shall have sealing glands and proper gasket.

3. In general, all conduits shall be sloping to drain. Bends that place a trap in a conduit shall be avoided. Provided drip fitting as required. Dux-Seal high ends of all underground raceways.

4. All conduit runs shall be mechanically and electrically continuous from outlet to outlet. Conduit size or type shall not be changed between outlets.

5. All empty raceways shall be equipped with pull lines, capped and labeled. Pull lines shall be 3/16” polypropylene, No. 14 AWG zinc-coated steel or

monofilament plastic line with not less than 200-lb tensile strength. Leave at least 24 inches of slack with identification tag at each end of the pull wire.

6. Minimum size of any conduit for lighting, power and signal shall be ¾" conduit unless shown otherwise.

7. Use temporary raceway caps to prevent foreign matter from entering. Immediately prior to installation of conductors, conduit shall be blown and swept free of foreign materials. All conduit stubs for future, both above and below grade, shall be capped. Run conduits for spare panelboard circuits to attic or accessible spaces.

8. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

9. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

10. There shall be no more than the equivalent of four quarter bends (360-degrees total) between pull points such as pull boxes, outlet boxes or conduit bodies, in one run of conduit.

11. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

12. Conduits shall be securely fastened to building structure at intervals not greater than ten feet.

13. Conduit shall be square cut and reamed if required to full size, with thread full cut and true.

14. Conduits shall be jointed by approved couplings with ends of conduits tightly butted. Non-insulating compound shall be used in making up joints below grade or inside on grade to insure a watertight system.

15. Conduit connections to outlet boxes or cabinets shall be made with approved connectors, using locknuts and insulated throat bushings.

16. Complete raceway installation before starting conductor installation.

17. Contractor shall provide rubber grommets to fasten galvanized conduit to exterior structures made of dissimilar metals at all exterior locations to prevent galvanic corrosion.

18. Contractor shall provide rubber grommets to fasten galvanized conduit to supports which are also used by other systems utilizing piping of dissimilar metals to prevent galvanic corrosion.

B. Interior

1. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

2. All concealed conduits shall be installed in as direct a line as possible between outlets. No more than four quarter bends, or their equivalent, will be allowed between outlets. Feeder conduits shall follow arrangement shown on plans unless a change is authorized. Branch circuit conduits shall, in general, follow arrangement as shown as far as structural conditions permit. All exposed runs shall parallel buildings, walls, or partitions, and be supported on Kindorf Hangers to meet Title 24, Part 3, CEC.

C. Exterior

1. Exterior conduit including the sweep below grade and the vertical riser shall be galvanized rigid steel conduit, except where rigid non-metallic conduit is required for utility service conduits by the serving utility company.

2. No rigid non-metallic conduit (RNC) shall be installed above grade.

D. Underground

1. Two or more power **or** telecommunications conduit runs installed in a common trench shall be separated horizontally by a minimum of four inches (4”).

2. Two or more power **and** telecommunications conduit runs installed in a common trench shall be separated horizontally by a minimum of twelve inches (12”).

3. **All** electrical conduit runs installed in a common trench with other utility company lines, plumbing pipes, or heating pipes shall be separated horizontally from such lines by a minimum of twelve inches (12”).

4. Conduits installed underground and not under buildings shall have a minimum of 24” of cover over the top of the conduit.

5. Utility service conduits shall be installed according to the serving utility’s requirements for material, depth of cover, and separation.

6. Rigid non-metallic conduit shall be laid on excavated firm bed, sealed watertight and unless with 24 inch earth cover, shall have 3 inch minimum concrete encasement unless under concrete. Plastic conduit without encasement shall be random lay, “snaked”, not pulled tight. Plastic conduit laid in areas of reinforcing steel shall be supported independently at each threaded fitting. Plastic conduit joints shall be full solvent welded.

7. Rigid non-metallic conduit installed underground and not below a building slab shall have a galvanized rigid steel long radius elbow installed at the terminating end where the transition from horizontal to vertical occurs.

E. In Concrete Slabs

1. Conduit installed within concrete slabs shall be Schedule 80 PVC rigid non-metallic conduit or full weight galvanized rigid steel conduit.

2. Conduits in concrete slabs 3 inches thick or less shall not be of size larger than ¾ inch nominal trade size, and wired to top of reinforcing steel.

3. Conduit installed in concrete slabs shall be installed in the middle third of the slab thickness where practical, and have at least 1-inch concrete cover.

4. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

5. Conduit installed in concrete slabs shall be installed side-by-side horizontally and shall have no less than 1” spacing between each conduit to allow for concrete consolidation to prevent voids in the concrete. Conduits that are installed in concrete slabs shall be arranged such that they do not cross over other conduits within the concrete slab. Where crossing of conduits is unavoidable the crossing sets of conduits shall be installed below the slab. No more than 3 conduits shall be installed side-by-side in a concrete slab without special permission from the structural engineer.

6. Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.

7. Contractor shall be responsible for damages to membrane and shall repair it.

F. Below Grade Level Concrete Building Slab

1. All conduits below the building slab shall be Schedule 40 PVC rigid nonmetallic conduit or full weight galvanized rigid steel conduit, and shall have a 6” minimum cover below the floor slab measured from the bottom of the floor slab to the top of the conduit.

2. Rigid non-metallic conduits that are 1” trade size or smaller that are installed below the building slab shall transition from Schedule 40 PVC below the building slab to Schedule 80 PVC rigid nonmetallic conduit or galvanized rigid steel conduit, before passing into the concrete building slab and shall transition to galvanized rigid steel conduit or IMC within the concrete building slab before exiting and rising above the building slab.

3. Rigid non-metallic conduits that are 1 ¼” trade size or larger that are installed below the building slab shall have a galvanized rigid steel long radius elbow installed at the terminating end where the transition from horizontal to vertical occurs and the vertical riser shall be galvanized rigid steel conduit rising above the building slab.

4. Rigid non-metallic conduit installed underground and not below a building slab.

5. Where conduits rise through the building slab they shall be installed at sufficient depth so that the curved portion of any bends, sweeps, or 90’s are not visible above the finished slab.

6. Contractor shall be responsible for damages to membrane and shall repair it.

G. Signal Systems

1. Separate 2” conduits between buildings shall be provided for each of the following systems – Fire Alarm, Burglar Alarm/Clock/Bell, Energy Management, Computer Network, Intercom/Telephone.

2. Two (2) spare 2” conduits shall be provided between buildings for future low voltage needs.

3. Two (2) spare 1” conduits shall be provided to each classroom and terminated in J-boxes above the ceiling for future low voltage needs.

4. Install telephone and signal system raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent.

5. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

H. In Beams and Footings

1. Conduit in concrete beam and footings shall be perpendicular to direction of beams unless otherwise indicated on structural drawings.

2. Conduit shown in concrete beam parallel to beams shall be installed at approximate mid-depth of beam.

I. Flexible Conduit

1. LFMC or FMC shall be used to connect motors and equipment subject to vibration, noise transmission, or movement to junction boxes, with a maximum length of 24-inches.

2. Install separate ground conductor across flexible connections.

3. Flexible conduits shall be independently suspended.

J. Hazardous Locations

1. Underground conduit **within** Class 1 areas shall be threaded rigid metal conduit or intermediate steel conduit per N.E.C. 511 and/or 514.

2. Underground conduit **below** Class 1 areas shall be rigid non-metallic conduit per N.E.C. 511 and/or 514.

3. Approved seal-off type fittings shall be used in Class 1 locations per N.E.C.

4. Fittings in hazardous areas shall be of the type approved for the particular hazard.

3.5 METAL CLAD TYPE MC-PCS CABLE APPLICATION

A. Lighting branch circuits **may** be Type MC-PCS cable only where they are completely concealed within walls or above ceilings.

B. Type MC-PCS cable **shall not** be permitted for branch circuits other than the controlled lighting branch circuits of individual spaces.

C. Type MC-PCS cable **shall not** be permitted for feeders.

D. Type MC-PCS cable **shall not** be permitted underground.

3.6 METAL CLAD CABLE – INSTALLATION

A. Install metal clad cable in accordance with manufacturer's instructions and in strict accordance with CEC Article 330. Follow manufacturer's explicit instructions when connecting the cable to fittings and boxes. Connectors shall be firmly secured to the cable, but not over tightened. Connector shall be firmly attached to metal boxes.

B. Support metal clad cables every 6 feet and within 12 inches of boxes, per CEC Article 334, using separate spring metal clip or metal cable ties (not steel tie wire) for each cable. Metal clad cables shall not be bundled together.

C. Suspended ceiling drop wire may be used to directly support a maximum of two separate metal clad cables.

D. Provide separate drop wire above accessible ceiling, to support more than two metal clad cables.

E. Do not rest metal clad cables on ceiling tiles or allow contact with mechanical piping systems.

F. Bend metal clad cable per CEC Article 334.

G. Provide separate sleeves and/or fire barriers where metal clad cable penetrates firewalls, unless cable is UL listed for the application.

3.7 CONDUCTOR APPLICATION

A. Feeders and branch circuits shall be Type THHN/THWN insulated conductors in raceway.

B. Underground feeders and branch circuits shall be Type THWN or single-wire, Type UF insulated conductors in raceway.

C. Branch circuits for other than lighting circuits shall be Type THW or THHN/THWN insulated conductors in raceway. Lighting branch circuits shall be Type THW or THHN/THWN insulated conductors in raceway where exposed and may be metal-clad cable where concealed in ceilings and gypsum board partitions.

D. Minimum conductor size shall be #12 for power and lighting, #14 for 120V control circuits and #18 for 24V control circuits.

E. Remote control, signaling and power-limited circuits shall be Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.8 CONDUCTOR INSTALLATION

A. Conductors shall be continuous from outlet to outlet, no splices shall be made except within outlet or junction boxes.

B. Wiring at outlets shall be installed with at least 12 inches of slack conductor at each outlet.

C. Outlet and component connections shall be made to wiring systems and to ground. Electrical connectors and terminals shall be tightened according to manufacturer's published torque-tightening values. Torque values specified in UL 486A shall be used where manufacturer's torque values are not indicated.

D. Wire in panels, cabinets, pull boxes, and wiring gutters shall be squared, labeled, and neatly grouped with cable ties and fanned out to the terminals.

E. All branch circuits, fixture wiring joints, splices, and taps for conductors #10 and smaller shall be made with 3M "Scotchlock" connectors, or approved equal.

F. All branch circuits, fixture wiring joints, splices, and taps for conductors #8 and larger shall be made with two-bolt type solderless connectors or T & B "color keyed" compression lugs.

G. Bolt-type solderless connectors shall be torqued with a torque wrench according to the manufacturer's recommendations, and then retightened after 24-48 hours before taping. Owners' inspector shall be informed of this procedure during the waiting period and shall witness the act of retightening.

H. Connectors and lugs for terminating stranded conductors #8 and larger shall be machine crimp compression type.

I. All splices shall be taped with Scotch #88 plastic electrical tape with "Scotch Fill" where necessary for a smooth joint. Scotch #27 or #2520 shall be used for other than normal temperatures or conditions. All connections and splices shall be electrically perfect and in strict accordance with all code requirements.

J. No splices shall be made below grade in a manhole or pullholes without Engineer's written approval, and then shall be encapsulated with 3M potting kits per 3M Specifications. For larger gauge wire where 3M potting kits are prohibited Contractor shall use submersible UL listed Polaris connectors by NSi.

3.9 WIREWAY AND AUXILIARY GUTTER APPLICATION

A. Wireways and auxiliary gutters shall be used above and below panelboards, lighting relay cabinets, and terminal cabinets to accommodate large concentrations of wires.

3.10 PULL BOXES AND WIREWAYS:

A. Boxes shall be installed square and plumb. An engraved nameplate shall be installed on each box indicating its function. Nameplate shall be installed on the exterior of each box in unfinished areas and on the interior of each box in finished areas.

B. Wireways shall be installed with strip-type connectors with self-retained mounting screws. Hangers with two piece, hook together features shall be used to permit preassembly of wireway and hanger bottom plate before hanging on a preinstalled upper bracket.

C. Pull and junction boxes shall be installed as shown to ease the pulling of wire and to comply with CEC requirements.

3.11 WIRING DEVICES AND MATERIALS

A. Outlets shall be mounted at 18” minimum above finished floor unless otherwise noted.

B. The locations of outlets shown on drawings shall be located with respect to work of others and to be symmetrical with room layout.

C. Outlets in architectural patterned surfaces such as tile and finish panels shall be centered on intersections of four panels or in exact center of panels, unless otherwise shown on architectural plans or directed by Architect.

D. Outlet boxes for concealed work shall be one-piece steel knock out type with zinc coating. Boxes shall not be smaller than 4” square nominal size, unless otherwise indicated. Extension rings, plaster rings, and covers shall be provided as necessary for flush finish.

E. The Contractor shall inform himself of wall thickness throughout the building and shall provide outlet boxes of suitable depth that can be flush mounted and yet will be deep enough to contain the particular apparatus involved. Location of exposed pull or junction boxes will be subject to the Architect’s approval.

F. Outlet boxes on opposite sides of walls shall not be placed back-to-back, nor shall “through” boxes be employed (except where specifically permitted on the drawings by note).

G. Switches shall be mounted 48” to top of device box above finished floor unless otherwise noted.

H. Where more than one switch occurs at the same location, use multiple gang outlet boxes covered by a single plate; provide box partitions as required by the N.E.C.

I. Bar hangers shall be used to support outlet boxes in stud or furred partitions and ceilings. Attachment screws, devices, etc., shall be of the proper type to secure boxes to metal studs complemented by expansion shields to concrete and masonry.

J. All outlet boxes and particularly those supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures, not from acoustic ceilings. All lighting fixture outlets shall be coordinated with mechanical, architectural, or other equipment to eliminate conflicts and provide a workable, neat installation.

K. Approved knock out holes shall be provided. Outlet boxes from which light fixtures will be suspended shall be equipped with 3/8" fixture studs fastened through from back of box.

L. Surface boxes of the cast metal threaded hub type with suitable gasketed covers shall be used for exposed conduit runs less than 5' above a finished floor or where waterproof boxes are required.

M. Floor boxes shall be adjustable, brass trimmed with carpet flanges where carpet is indicated on architectural drawings.

N. Set floor boxes level and trim after installation to fit flush to finished floor surface.

O. Masonry boxes shall have conduit entrances to rear of box with depth as required to clear masonry.

P. Boxes shall be sized for number of conductors entering box.

Q. Wiring devices shall be securely fastened to the outlet box. Where the outlet box covers are back from the finished walls, the device shall be built out with washers so that it is rigidly held in place to the box. Metal extenders shall be provided in flammable construction per CEC.

R. All device screw slots shall be left in a vertical orientation.

S. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor and to outlet box with bonding jumper.

T. Connect ground terminal of isolated-ground receptacles to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

3.12 TERMINAL CABINETS AND CLOSETS

A. Terminal cabinets shall be installed level and identified with nameplate per schedule.

B. All conductors in terminal cabinets or closets shall be squared, labeled and secured neatly with wire ties.

C. All terminal cabinets shall be installed with the top of the trim at 6'-0" above the finished floor, unless otherwise indicated on the drawings.

D. Where space permits, terminal cabinets shall be surface mounted where they are not visible to the public.

E. A typewritten directory shall be mounted behind plastic in a metal holder welded to the inside of each terminal cabinet door showing a complete description of terminations in each cabinet.

3.13 PANELBOARDS

A. All panels shall have, in addition to conduit shown on the drawings, two ¾" and three 1" conduits stubbed to nearest accessible attic space.

B. All panels shall be installed with the top of the trim at 6'-0" above the finished floor, unless otherwise indicated on the drawings.

C. Where space permits, panels shall be surface mounted where they are not visible to the public.

D. A typewritten directory shall be mounted behind plastic in a metal holder welded to the inside of each panel door showing circuit numbers and complete description of all outlets on each circuit and an Arc-Flash Hazard Warning label shall be applied to each panelboard, switchboard and service entrance in accordance with CEC 110.16.

E. Labeling of all circuits at panel boards shall match the exact room names of each of the spaces. Verify exact room names with Owner prior to labeling.

F. Electrical loads shall be disaggregated into separate panelboards per the 2022 California Energy Code Section 130.5(b).

3.14 DISCONNECT DEVICES

A. Thoroughly examine site conditions for acceptance of disconnects switch installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

B. Coordinate locations of switches and equipment in the field to provide code required clearances in front of switches and to insure that switches are in sight of the controllers as described in NEC Article 430.

C. Install disconnect switches where indicated on the Drawings.

D. Install fuses in fusible disconnect switches.

E. Include construction channel and mounting hardware as required to support disconnect switch.

F. Provide engraved, machine screw retained nameplate on each disconnect switch. Name plate shall identify equipment and panelboard + branch circuit breaker.

3.15 SUPPORTING DEVICE APPLICATION

A. Hot-dip galvanized materials or nonmetallic channel and angle system components shall be used in damp locations and outdoors.

B. Steel materials shall be used in dry locations.

C. Support clamps for PVC raceways shall be click-type clamp system.

D. Strength of supports shall be adequate to carry present and future loads, times a safety factor of at least four with a minimum of 200-lb design load.

3.16 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, according to the following criteria, unless otherwise noted:

1. Wood – wood screws or screw-type nails.

2. Masonry – toggle bolts on hollow masonry units, expansion bolts on solid masonry units.

3. New Concrete – concrete inserts with machine screws and bolts.

4. Existing Concrete – expansion bolts.

5. Steel – welded threaded studs or spring-tension clamps on steel. Field welding shall comply with AWS D1.1. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.

6. Light Steel – sheet-metal screws.

7. Fasteners shall be selected so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.17 ELECTRICAL IDENTIFICATION

A. Each conductor of every system shall be permanently tagged in each panelboard, pull box, J-box, etc., in compliance with the Occupational Safety and Health Administration (OSHA).

B. Brady labels shall be used to identify terminals and destination of feeders, branch circuits, signal and control circuits, etc., at all terminations, junction boxes and pull boxes, and shall be coordinated with the nameplates in all boxes and equipment.

C. All terminals in the switchboards, panels, relays, switches, devices, starter terminals, etc., shall have Brady labels for identification to identify both ends of all wiring.

D. The Contractor shall furnish and install 1” x 3” x 3/32” thick laminated black Bakelite nameplates with a white core (unless specifically shown as red) engraved to produce white letters on black background for all items of electrical equipment, including 2-pole and 3-pole circuit breakers, panelboards, starters, relays, time switches and disconnect switches.

E. All devices shall have their branch circuit identified on the back side of device plate with a permanent type black marker, i.e. CT A-21. Identify panelboard and circuit

number from which receptacles are served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

F. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

G. Panels having single-pole circuit breakers shall be provided with typed schedules mounted in welded metal holders behind plastic.

H. Clean surfaces that are to receive self-adhesive identification products before applying.

I. Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

J. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

K. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

L. All power conductors shall be identified in accordance with the following schedule:

1. 120/208V, 3 Phase, 4 Wire System.
    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.
    d. Neutral: White.
    e. Ground: Green
2. 277/480V, 3 Phase, 4 Wire System.
    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.
    d. Neutral: White with a colored stripe or gray.
    e. Ground: Green.

M. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed

for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

N. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.18 FIRESTOPPING

A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration, either before, during, or after the fire. The fire **and** temperature ratings of the penetration assembly shall be at least that of the floor, wall, or ceiling into which it is installed so that the original fire rating of the floor or wall is maintained as required by Article 300.21 of the California Electrical Code (CEC).

B. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs and similar structures. Where applicable, provide 3M fire barrier sealing penetration system, and/or Thomas and Bett Flame Safe Fire Stop System, and/or Chase Foam fire stop system, including wall wrap, partitions, caps and other accessories as required. All manufacturers' instructions and recommendations for installation of sealing fittings and barrier sealing systems.

C. The Contractor shall repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed new structures, surfaces and shall install new fireproofing where existing firestopping has been disturbed. The repair and refinishing of materials and other surfaces shall be by skilled mechanics of the trades involved.

3.19 REFINISHING AND TOUCHUP PAINTING

A. The Contractor shall clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location. He shall follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

B. Damage to galvanized finishes shall be repaired with zinc-rich paint recommended by manufacturer.

C. Damage to PVC or paint finishes shall be repaired with matching touchup coating recommended by manufacturer.

3.20 SYSTEM TESTING AND STARTUP

A. Refer to Specification Section 269500 "Electrical Acceptance Tests" for minimum required systems testing and startup.

3.21 TITLE 24 - PART 6 DOCUMENTATION OF INSTALLATION AND ACCEPTANCE FOR ELECTRICAL POWER DISTRIBUTION SYSTEMS

A. The Contractor shall prepare and submit the following Certificates of Installation:

1. Electrical:

a. Certificate of Installation – Electrical Power Distribution (NRCI-ELE-01-E)

END OF SECTION 260500

SECTION 260526
GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.3 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Product Data for grounding rods, connectors and connection materials, and grounding fittings.

C. Qualification data for firms specified in "Quality Assurance" Article to demonstrate their capabilities and experience.

D. Field tests and observation reports certified by the testing organization and indicating and interpreting the test reports for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, or a full member company of the InterNational Electrical Testing Association (NETA).

1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Comply with UL 467.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chance: A. B. Chance Co.
2. Erico Inc.; Electrical Products Group.
3. Galvan Industries, Inc.
4. Lyncole XIT Grounding.
5. Raco, Inc.
6. Thomas & Betts, Electrical.

2.2 GROUNDING AND BONDING PRODUCTS

A. Where types, sizes, ratings, and quantities indicated are in excess of California Electrical Code (CEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3 WIRE AND CABLE GROUNDING CONDUCTORS

A. Conform to CEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

1. Material: Copper.

B. Equipment Grounding Conductors: Insulated with green color insulation.

C. Grounding-Electrode Conductors: Stranded cable.

D. Isolated Grounding Conductors: Insulated with green color, yellow striping insulation.

E. Bare Copper Conductors: Conform to the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

2.4 TELECOMMUNICATION MAIN GROUND BUS

A. Telecommunication main ground bus: 4”W x 1/4”H x 12”L UL listed and pre-assembled telecommunication main ground bus consisting of bare annealed-copper bar having

pre-drilled hole patterns to accommodate two-hole lugs and with two 3/8” diameter mounting holes spaced 5.75” apart, 2-insulators, 2-stainless steel stand-off brackets, 4-stainless steel bolts, 4-lock washers and 4-flat washers + lug kit. Chatsworth model 40158-12, or equivalent.

2.5 TELECOMMUNICATION GROUND BUS

A. Telecommunication ground bus: 2”W x 1/4”H x 12”L UL listed and pre-assembled telecommunication ground bus consisting of bare annealed-copper bar having pre-drilled hole patterns to accommodate two-hole lugs and with two 3/8” diameter mounting holes spaced 5.75” apart, 2-insulators, 2-stainless steel stand-off brackets, 4-stainless steel bolts, 4-lock washers and 4-flat washers + lug kit. Chatsworth model 40156-12, or equivalent.

2.6 MISCELLANEOUS CONDUCTORS

A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.

B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Bonding Straps: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.7 CONNECTOR PRODUCTS

A. Grounding connections shall be exothermic welded, bolted clamp terminal, or pressure connector type.

B. Exothermic-Welded Connections shall be provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

C. Bolted Clamp connectors shall be heavy-duty type.

D. Pressure connectors shall be high-conductivity-plated units.

2.8 GROUNDING ELECTRODES AND TEST WELLS

A. Grounding Rods shall be sectional type; copper-clad steel.

1. Size: 3/4 inch by 120 inches.

B. Plate Electrodes shall be copper, square or rectangular shape. Minimum 0.10 inch thick, size as indicated.

C. Test Wells shall consist of a Christy Concrete Products F8 Box, or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. The conduit system, supports, cabinets, switchboards, etc., and neutral conductors must be permanently and effectively grounded by means of approved ground clamps, in accordance with Title 24 of the California Code of Regulations. The neutral shall only be grounded at the main service location unless specifically noted otherwise on the drawings or required by the California Electrical Code.

B. This Contractor shall exercise every precaution to obtain good contacts at all panel boxes, pull boxes, etc. Where it is not possible to obtain good contacts, the conduits shall be bonded around the boxes with a #6 AWG gauge, THWN wire with ground clamps.

C. Where there is more than one building supplied from a common service, provide a grounding electrode system at each building per CEC 250.50 and connect per CEC 250.32(B)(1).

3.2 APPLICATION

A. General

1. All equipment cases, motor frames, etc. shall be completely grounded to satisfy applicable code requirements.

2. The interior hot and cold water piping and the interior above ground gas piping shall be bonded to the building service equipment per CEC 250.104.

3. Do not use underground gas piping as a grounding electrode.

B. Equipment Grounding Conductor

1. Pull an Equipment Grounding Conductor, insulated green, in **ALL** conduits, both metallic and non-metallic, unless they are designated for telephone or data cables.

2. Each disconnect switch shall have an Equipment Grounding Conductor (lay in wire type) which shall be used for grounding the disconnect enclosure. The ground wire shall continue and be connected to the enclosure of the equipment served.

3. Feeders and branch circuits shall be provided with an insulated grounding conductor run with the circuit conductors. This grounding conductor shall be in addition to the ground path provided by the continuously grounded metallic raceway system that encloses the phase and neutral conductors.

4. Comply with CEC Article 250 for types, sizes, and quantities of Equipment Grounding Conductors, except where specific types, larger sizes, or more conductors than required by CEC are indicated.

5. Install separate Equipment Grounding Conductor in branch circuit runs from computer area power panels or power-distribution units.

C. Isolated Grounding Conductor

1. Pull a separate Isolated Grounding (IG) conductor, insulated green with yellow stripe, to each isolated ground receptacles, in addition to the equipment-grounding conductor.

2. The IG Conductor shall begin at the grounding source of the applicable derived system or service and shall not be connected to any neutral conductor or any item not isolated from the system ground. Each IG circuit shall have a separate neutral **and** a separate IG Conductor (not used for more than one circuit).

D. Isolated Equipment Enclosure Circuits

1. For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install an Isolated Grounding Conductor.

E. Air-Duct Equipment Circuits

1. Install an Equipment Grounding Conductor to duct-mounted electrical devices operating at 120 V and above, including air cleaners and heaters. Bond conductor to each unit and to air duct.

F. Water Heater, Heat-Tracing, and Anti-frost Heater Circuits

1. Install a separate Equipment Grounding Conductor to each electric water heater, heat-tracing assembly, and anti-frost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

G. Signal and Communication Systems

1. For telephone, alarm, voice and data, and other communication systems, provide a No. 3/0 AWG minimum insulated copper grounding conductor in raceway from the building grounding-electrode system to a telecommunication main ground bus at the building telecommunication service entrance telephone backboard.

H. MDF Cabinets, IDF Cabinets, and Remote Telecommunication Cross Connect Rooms

1. Each MDF Cabinet and each IDF Cabinet shall have a telecommunication ground bus installed within the cabinet and the telecommunication ground bus shall be connected to the telecommunication main ground bus with a No. 4 AWG minimum insulated copper grounding conductor installed within a raceway.

I. Terminal Cabinets

1. Terminate grounding conductor on cabinet grounding terminal.

J. Metal Poles Supporting Outdoor Lighting Fixtures

1. Ground pole to equipment grounding conductor run with supply branch circuit.

3.3 INSTALLATION

A. General: Ground electrical systems and equipment according to CEC requirements, except where Drawings or Specifications exceed CEC requirements.

B. Grounding Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.

1. Drive until tops are 2 inches below finished floor or final grade, except as otherwise indicated.

2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.

C. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 inches below grade.

E. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.

F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.

G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

H. Test Wells: One for each driven grounding electrode, except as otherwise indicated. Set top of well flush with finished grade or floor. Fill with 1-inch- maximum-size crushed stone or gravel.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to CEC Paragraph 250.52(A)(3), using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG. Where base of concrete foundation is less than 20 feet in length, coil excess conductor within base of concrete foundation. Bond grounding conductor to reinforcing steel to at least 4 locations, and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.4 CONNECTIONS

A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Non-contact Metal Raceway Terminations: Where metallic raceways or metallic sheathed cables terminate at metal housings without mechanical and electrical connection to the housing, terminate each metallic raceway or metallic sheathed cable with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits or sheathed cables at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and grounding rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Manholes:

1. Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor.

2. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall.

3. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

B. Connections to Manhole Components:

1. Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole, to ground rod or grounding conductor.

2. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor.

3. Train conductors level or plumb around corners and fasten to manhole walls.

4. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.6 FIELD QUALITY CONTROL

A. Refer to Specification Section 269500 “Electrical Acceptance Tests” for minimum required testing of Grounding System.

3.7 ADJUSTING AND CLEANING

A. Restore surface features, including vegetation, at areas disturbed by work of this Section. Reestablish original grades, except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 02 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 260526

SECTION 261340
CABLE TRAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. Provide a complete system of cable tray throughout the building and within IT and Server Rooms. The system of cable tray shall include trays, elbows, fittings, offsets, grounding lugs and bonding jumpers, supports and bracing and other tray accessories needed for a complete system.

1.3 CODES AND STANDARDS

A. Cable trays shall conform to the following codes and standards:

1. 2022 California Electrical Code;
2. NEMA VE 1 Metal Cable Tray Systems;
3. NEMA VE 2 Cable Tray Installation Guidelines;

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This design is based on the use of cable tray manufactured by Cablofil. Subject to compliance with project requirements, equivalent product by one of the following manufacturers may be considered.

1. Cablofil;
2. B-Line;
3. PW Industries, Inc;

2.2 LADDER TYPE CABLE TRAY

A. Ladder type cable tray shall be a complete system of Cablofil Cable Runway including straight sections, elbows, offsets, grounding lugs and bonding jumpers, connectors, accessories, supports and bracing to form a complete system.

B. Construction: Ladder type cable tray shall be 12-inches wide and have tubular side rails constructed of rectangular steel tube per ASTMA-513 with rungs constructed of rectangular steel bar per ASTMA-36 arc-welded between rails at 9” on center. Ladder type cable trays shall have a 7/16” ground hole drilled at each end of each section and each section shall be bonded with a #1 AWG copper bonding jumper. Ladder type cable trays shall be black in color.

C. Inside radii of elbows shall be 12-inches.

D. Two cable dropouts shall be furnished and installed at the location of each server rack.

E. Accessories and fittings: Manufacturer’s standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and ground straps.

F. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.

2.3 WIRE BASKET TYPE CABLE TRAY

A. Wire basket type cable tray shall be a complete system of Cablofil CF Series Wire Cable Tray including straight sections, elbows, offsets, grounding lugs and bonding jumpers, connectors, accessories, supports and bracing to form a complete system.

B. Construction: Wire basket type cable tray shall be 18-inches wide by 2-inches deep Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture. Finish for Carbon Steel Wire after welding and bending of mesh shall be Hot-Dip Galvanizing: ASTM A 123. Cable tray will consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat, with UL Classified splices where tray acts as Equipment Grounding Conductor (EGC). Wire mesh cable tray will have continuous Safe-T-Edge T-welded top side wire to protect cable insulation and installers. Wire mesh shall be 2-inches x 4-inches.

C. Wire mesh cable tray fittings and offsets shall be field-fabricated from straight tray sections, in accordance with manufacturer’s written instructions.

D. One cable dropouts shall be furnished and installed at each location where data cabling transitions between ladder type cable tray and wire basket type cable tray.

E. Accessories and fittings: Manufacturer’s standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and ground straps.

F. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Thoroughly examine site conditions for acceptance of cable tray installation to verify conformance with manufacturer and specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.2 PREPARATION

A. Location of cable tray shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor obstruct access to mechanical or electrical equipment. Provide offsets as required to avoid obstruction of cable tray with other trades.

B. Exposed cable trays shall be run parallel or at right angles to the centerlines of columns and beams.

C. Cable trays shall not be placed closer than 12-inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.

D. Cable trays shall not be placed closer than 3-inches to any branch circuit power raceway.

3.3 INSTALLATION

A. Install cable tray in accordance with manufacturer’s written instructions.

B. Installation shall conform to NEMA VE 2 requirements.

C. Support cable tray at each connection point, at the end of each run and at other points to maintain spacing between supports of 8-feet maximum.

D. Cable tray support shall be a trapeze type hanger system consisting of two (2) 3/8” threaded rods supported from structure above with 1-5/8” x 1-5/8” construction channel span between. Channel shall have 1” slots spaced 2” on center and be mounted with open side down. Mount cable tray on trapeze hanger using hold-down clamps to secure.

E. Provide lateral bracing support along cable tray spaced at a maximum of 30’-0” on center. Bracing shall consist of 1-5/8” x 1-5/8” construction channel attached to one side of trapeze channel and installed at a 45-degree angle up to structural

slab. Anchor bracing channel to slab with expansion bolts. Alternate bracing on both sides of cable tray.

F. Provide bonding continuity between all cable tray sections and fittings.

3.4 THRU-WALL PENETRATIONS

A. Where cable tray encounters full height walls, cable tray shall end 6-inches from each side of full height wall and two (2) 4-inches conduit sleeves shall be installed to facilitate telecommunication cable pass-thru. Where a full height wall is part of a fire-rated assembly STI Firestop Spec Seal FS400 4” firestop thru-wall fire stopping sleeves shall be installed on each end of both 4-inch conduit sleeves in accordance with UL listing and manufacturer’s written instructions. A bonding jumper shall be installed thru the conduit sleeves and separate sections of cable tray shall be bonded.

END OF SECTION 261340

SECTION 262213
DRY-TYPE TRANSFORMERS (600 V AND LESS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. Provide and install dry-type **Energy Efficient** distribution transformers meeting United States Department of Energy DOE 2016 Energy Efficiency standards, with primary and secondary voltages of 600V and less and capacity ratings 15kVA through 1000kVA.

B. Provide and install dry-type **control and signal** transformers, with primary and secondary voltages of 600V and less, with capacities up to 1000 VA.

1.3 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of wall-mounting and structure-hanging supports.

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Product Data

1. Submit rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

C. Shop Drawings

1. Submit wiring and connection diagrams.

D. Manufacturer Seismic Qualification Certification

1. Submit certification that transformer assembly and components will withstand seismic forces defined in Specification Section 260100, "Seismic Anchorage and Bracing". Include the following:

a. Indicate whether withstand certification is based on actual test of assembled components or on calculation.

b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Submit Dimensioned Outline Drawings of Equipment Unit identifying center of gravity and locating and describing mounting and anchorage provisions.

3. Submit detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Test Reports

1. Submit source quality-control test reports.

2. Submit record of tap adjustments specified in Part 3 of this Section.

F. Operation and Maintenance Data

1. Submit operation and maintenance data for transformers to include in maintenance manuals specified in Division 01 and Specification Section 260100.

1.5 QUALITY ASSURANCE

A. Transformers shall be manufactured and tested in accordance with NEMA ST 20-2014, “Dry-Type Transformers for General Applications”.

B. Transformers and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Transformers shall comply with IEEE C 57.12.91-2011, “IEEE Standard Test Code for Dry-Type Distribution and Power Transformers”.

D. Transformers shall comply with UL 1561, “Standard for Dry-Type General Purpose and Power Transformers”.

E. Transformers losses for **Energy-Efficient Transformers**, rated 15 kVA and larger, shall be tested in accordance with the United States Code of Federal Regulations 10-CFR-431.196 procedures and shall be certified as meeting United States Department of Energy DOE 2016 Energy Efficiency Standards.

1.6 CODES AND STANDARDS

A. All work and materials shall fully comply with current rules and regulations of all applicable codes. Nothing in these Drawings or Specifications shall be interpreted as to permit any work not in compliance with these codes. Where work is detailed and/or specified to a more restrictive standard or higher requirement, that standard or

requirement shall govern such work. Installation shall comply with the following codes and standards:

1. California Code of Regulations (CCR)
    a. Title 8, Industrial Relations
    b. Title 17, Public Health
    c. Title 24, Building Standards
2. 2022 California Building Code
3. 2022 California Fire Code
4. 2022 California Electrical Code
5. 2022 California Energy Code
6. Local Codes
7. NEMA ST 20-2014
8. IEEE C 57.12.91-2011
9. UL 1561
10. United States Department of Energy DOE 2016 Energy Efficiency Standards

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This design is based on the use of equipment manufactured by Square D Company. Subject to compliance with project requirements, equivalent products by one of the following manufacturers may be considered:

1. Square D Company
2. General Electric Company
3. Eaton
4. Siemens

B. Approved manufacturers shall be registered firms in accordance with ISO 9001:2015 SIC 3612 (US); which is the design and manufacture of low voltage dry type power, distribution, and specialty transformers.

2.2 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Transformer cores shall be constructed from high grade, grain-oriented, non-aging silicon steel with high magnetic permeability and low losses.

C. Transformer coils shall be of continuous wire-wound construction without splices, except for taps and shall be impregnated with non-hygroscopic, thermosetting varnish.

2.3 ENERGY EFFICIENT DISTRIBUTION TRANSFORMERS

A. Ratings

1. All insulating materials are to exceed NEMA ST 20 standards and be rated for 220°C UL component recognized insulation system.

2. Transformers 15kVA and larger shall be 150°C temperature rise above 40°C ambient. Transformers 25kVA and larger shall have a minimum of 4 - 2.5% full capacity primary taps. Exact voltages and taps to be as designated on the plans or the transformer schedule.

3. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.

4. Transformers shall have minimum efficiencies per DOE 2016 Energy Efficiency Standards when operated at 35% of full load capacity. Efficiency shall be tested in accordance with the United States Code of Federal Regulations 10-CFR-431.196 procedures.

Single Phase	
kVA	Efficiency
15	97.7%
25	98.0%
37.5	98.2%
50	98.3%
75	98.5%
100	98.6%
167	98.7%
250	98.8%
333	98.9%

Three Phase	
kVA	Efficiency
15	97.89%
30	98.23%
45	98.40%
75	98.60%
112.5	98.74%
150	98.83%
225	98.94%
300	99.02%
500	99.23%
750	99.28%

B. Construction

1. Transformer coils shall be of the continuous wound copper construction and shall be impregnated with non-hygroscopic, thermosetting varnish.

2. All cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating. Cores for transformers greater than 500kVA shall be clamped utilizing insulated bolts through the core laminations to ensure proper pressure throughout the length of the core. The completed core and coil shall be bolted to the base of the enclosure but isolated by means of rubber vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and

the enclosure except for a flexible safety ground strap. Sound isolation systems requiring the complete removal of all fastening devices will not be acceptable.

3. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.

4. The transformer enclosures shall be ventilated and fabricated of heavy gauge, sheet steel construction. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning, and phosphatizing, followed by electrostatic deposition of polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces. The coating shall be UL recognized for outdoor use. The coating color shall be ANSI 49.

C. Sound levels shall be warranted by the manufacturer not to exceed the following:

1. 15 to 50KVA - 45dB; 51 to 150kVA - 50dB; 151 to 300kVA - 55dB; 301 to 500kVA - 60dB; 501 to 700kVA - 62dB; 701 to 1000kVA - 64dB; 1001 to 1500kVA - 65dB; 1501 to 2000kVA- 66dB

2.4 CONTROL AND SIGNAL TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty, complying with NEMA ST 1, and listed and labeled as complying with UL 506.

B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

2.6 ACCESSORIES

A. Provide weather shields for all transformers located outdoors.

B. Provide a locking mechanism for each circuit breaker a supplying Class 1 transformer that is lockable in the off position. Provide and install a field applied marking on the transformer indicating the location of the remote mounted transformer primary disconnecting means.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls and floors for suitable mounting conditions where transformers will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Specification Section 260100, "Seismic Anchorage and Bracing."

B. Install floor-mounting transformers level on concrete bases. Construct concrete bases of dimensions indicated, but not less than 4-inches larger in both directions than supported unit and 4-inches thick.

C. Anchor transformers to concrete bases according to manufacturer's written instructions and per anchorage details in drawings.

D. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Ground equipment according to Division 26 Section "Grounding".

3.4 ADJUSTING

A. Refer to Specification Section 269500, Electrical Acceptance Testing, for minimum required transformer testing by Contractor.

END OF SECTION 262213

SECTION 262413
SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. Furnish and install Main Switchboard ‘MSB’ as herein specified and as shown on Drawings.

1.3 REFERENCES

A. The switchboard and overcurrent protection devices referenced herein shall be designed and manufactured according to the following appropriate specifications.

1. 2022 California Electrical Code (CEC).
2. NEMA PB 2 - Deadfront Distribution Switchboards, File E8681
3. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
4. UL 489 - Molded Case Circuit Breakers.
5. UL 891 - Dead-Front Switchboards.

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Shop Drawings

1. Submit Shop Drawings for each switchboard indicating front and side enclosure elevations with overall dimensions, conduit entrance locations and requirements, nameplate legends, one-line diagrams, equipment schedule and switchboard instrument details.

C. Test Reports

1. Submit certified reports of Independent Tests and Observations indicating and interpreting test results specified in Part 3 of this Section.

2. Submit calibration record for all testing devices used.

3. Submit certificates, signed by Contractor, certifying that Independent Testing Agency complies with requirements specified in Section 260100 / 269500, Article 1.2.

D. Operation and Maintenance Data

1. Submit operation and maintenance data for switchboards to include in “Operations and Maintenance Instructions” manuals specified in Division 01 and Specification Section 260100, Article 1.6, including detailed manufacturer’s written instructions on adjusting overcurrent protective devices.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

B. Each switchboard section shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.

C. Inspect and report concealed damage to carrier within their required time period.

D. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.6 PROJECT CONDITIONS

A. Verify dimensions by field measurements.

B. Determine suitable path for moving switchboard into place considering project conditions.

C. Verify clearance requirements. Locate switchboard to meet installation tolerances.

D. Revise locations and elevations from those indicated as required to suit project conditions.

1.7 WARRANTY

A. Manufacturer shall warrant equipment to be free from defects in materials and workmanship for the lesser of one (1) year from date of installation or eighteen (18) months from date of purchase.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This design is based on the use of equipment manufactured by Square D Company. Subject to compliance with project requirements, equivalent products by one of the following manufacturers may be considered:

1. Square D Company
2. General Electric Company
3. Eaton
4. Siemens

2.2 SWITCHBOARD - GENERAL

A. Switchboards shall be rated with a minimum short circuit current rating 65,000 rms symmetrical amperes at 480 VAC maximum. Continuous bus ratings shall be as shown on drawings. Switchboards shall be legibly marked with the maximum available fault current obtained from the utility company; the marking shall include the date that the fault current calculation was performed.

B. Switchboards shall bear an Arc-Flash Hazard warning label in accordance with CEC Article 110.16.

C. This switchboard containing a main circuit breaker utilized as the building main disconnect shall have a permanently installed user-accessible meter Square D Power Logic Model PM5560 with 10/100BaseTx UTP port, RS-485 Modbus serial master port, Ethernet to serial line gateway, embedded web server, two Ethernet ports with Modbus TCP protocol and two Ethernet ports with BACnet/IP protocol. The user-accessible meter shall provide all of the following functions:

1. Instantaneous (at the time) kW demand
2. Historical peak kW demand
3. Resettable kWh
4. kWh per rate period
5. Ethernet network connection

D. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

E. Enclosure shall be NEMA 250, Type 3R (Outdoors).

1. Sections shall be aligned front and rear.

2. Switchboard height shall be 91.5 inches including 1.5-inch floor sills and excluding lifting members and pull boxes.

3. The switchboard shall be of deadfront construction.

4. The switchboard frame shall be of formed steel rigidly bolted together to support all cover plates, bussing and component devices during shipment and installation.

5. Steel base channels shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.

6. Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduit.

7. Barriers shall be provided between adjacent switchboard sections.

8. The switchboard enclosure shall be painted on all exterior surfaces in the manufacturer’s standard color, applied over a corrosion-resistant undercoating.

9. Top and bottom conduit areas shall be clearly indicated in shop drawings.

F. Provide 1in H X 3in W engraved laminated nameplates for each device. Furnish black letters on a white background for all voltages.

G. Bus Composition shall be plated copper. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown in the plans. For 4-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus is not acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.

H. Bus Connections shall be bolted with Grade 5 bolts and conical spring washers.

I. Ground Bus shall be sized per NFPA 70 and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Provisions for the addition of future sections shall be provided.

J. The switchboard shall be accessible from the front.

2.3 MAIN OVERCURRENT PROTECTIVE DEVICE

A. Main Circuit Breaker shall be a fixed mounted, full function, electronic trip molded case circuit breaker.

1. Circuit breaker trip system shall be microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as directed by Engineer.

2. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.

3. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously.

4. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.

    a. Long Time Pickup

    b. Long Time Delay

    c. Short Time Pickup

    d. Short Time Delay (I^2t IN and I^2t OUT)

    e. Instantaneous Pickup

    f. Ground Fault Pickup

    g. Ground Fault Delay (I^2t IN and I^2t OUT)

5. Circuit breakers with adjustable short-time function shall be provided with defeatable instantaneous adjustment and 30 cycle short-time withstand ratings. Short-time withstand ratings shall be specified in rms symmetrical amperes, as shown on the drawings.

6. A means to seal the rating plug and trip unit adjustments in accordance with CEC Section 240.6(C) shall be provided.

7. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.

8. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in True rms with 2% accuracy.

9. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.

10. The trip system shall include a Long-Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.

11. Circuit breaker trip systems shall include an externally accessible test port for use with a Universal Equipment Test Set. The test set shall be suitable for testing

all electric circuit breakers specified for this project. Circuit breakers shall not require disassembly for testing.

12. Provide one (1) Universal Equipment Test Set for this project job for final inspection.

13. The main circuit breaker shall have an arc energy reduction feature to reduce clearing time. The arc energy reduction feature shall be an energy-reducing maintenance switch with a local status indicator. When the switch is turned on it shall reduce the clearing time and sets the instantaneous pickup clearing time to be 2 times faster than the normal instantaneous pickup sensor amperage.

14. The main circuit breaker shall be rated to allow it to be backfed by a solar photovoltaic or other on-site electrical energy generation system.

2.4 DISTRIBUTION OVERCURRENT PROTECTIVE DEVICES

A. Distribution Circuit Breakers shall be NEMA AB 1, enclosed, Molded-Case Circuit Breakers, with lockable handles.

1. Frame size, trip rating, number of poles, and auxiliary devices shall be as indicated and interrupting capacity rating shall meet available fault current.

2. Overcurrent devices shall be listed for application, including switching fluorescent lighting loads or heating, air-conditioning and refrigerating equipment.

3. Circuit breakers, 400A and larger shall be equipped with trip units interchangeable within frame size.

4. Circuit breakers supplying Class 1 transformers shall be lockable in the off position.

5. Mechanical lugs and power-distribution connectors shall be provided for number, size, and material of conductors indicated.

B. Where indicated, equip compartments with mounting brackets, supports, bus connections, and appurtenances designed for future overcurrent protective device of types and ampere ratings indicated.

2.5 SURGE PROTECTION

A. Main Switchboard ‘MSB’ shall be provided with a Type 2 surge protective device (SPD) that is connected on the load side of the main overcurrent protective device.

B. General Requirements for Surge Protective Devices:

1. Comply with UL 1449 and be a listed device.

2. Modular design with field-replaceable modules, or non-modular design.

3. Short-circuit current rating 100 kA interrupting capacity.

4. 120kA surge current capacity with surge event counter.

5. Bolted compression lugs for internal wiring.

6. 480Y/277-volt, 3-phase, with integral disconnect switch utilizing a 30-amp thermal-magnetic circuit breaker.

7. Redundant suppression circuits.

8. LED indicator lights for power and protection status and push to test diagnostic switches.

9. Audible alarm, with silencing switch, to indicate when protection has failed.

10. Form-C contacts rated at 2A and 24Vac/24Vdc, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive switchboard to provide adequate clearance for switchboard installation.

B. Check that concrete pads are level and free of irregularities.

C. Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install switchboard in accordance with manufacturer's written guidelines, the CEC, and local codes.

B. Support switchboards on concrete housekeeping bases, 6-inch nominal thickness.

C. Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Provide a permanent plaque on the outside of the door of the main switchboard reading, “CAUTION: MULTIPLE SOURCES OF POWER”. The plaque shall graphically illustrate and denote the location of each power source and shall be correctly oriented with respect to the diagrams location.

3.3 CONNECTIONS

A. Connect switchboards and components to wiring systems and to ground as indicated and instructed by manufacturer.

B. Tighten electrical connectors and terminals, including screws and bolts, according to manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicates, use those specified in UL 786A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Refer to Specification Section 269500, Electrical Acceptance Testing, for minimum required switchboard testing by Contractor and Independent Testing Agency.

3.5 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturer's specifications.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values as instructed by the Engineer.

3.6 CLEANING

A. Upon completion of installation, inspect interior and exterior of the switchboard. Remove paint spatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 262413

SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. Furnish and install panelboards as herein specified and as shown on Drawings.

1.3 REFERENCES

A. The panelboards and overcurrent protection devices referenced herein shall be designed and manufactured according to the following appropriate specifications.

1. 2020 NFPA 70 and 2022 California Electrical Code (CEC).
2. NEMA PB 1 - Panelboards
3. NEMA PB 1.1 – General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
4. UL 489 - Molded Case Circuit Breakers.
5. UL 67 – Standards for Panelboards.

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Shop Drawings

1. Submit Shop Drawings for each panelboard indicating front and side enclosure elevations with overall dimensions, conduit entrance locations and requirements, nameplate legends, one-line diagrams, equipment schedule and switchboard instrument details.

C. Test Reports

1. Submit certified reports of Independent Tests and Observations indicating and interpreting test results specified in Part 3 of this Section.
2. Submit calibration record for all testing devices used.

3. Submit certificates, signed by Contractor, certifying that Independent Testing Agency complies with requirements specified in Section 260100 / 269500, Article 1.2.

D. Operation and Maintenance Data

1. Submit operation and maintenance data for panelboards to include in “Operations and Maintenance Instructions” manuals specified in Division 01 and Specification Section 260100, Article 1.6, including detailed manufacturer’s written instructions on adjusting overcurrent protective devices.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

B. Each panelboard shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.

C. Inspect and report concealed damage to carrier within their required time period.

D. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

E. Handle in accordance with NEMA PB 1.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.

1.6 PROJECT CONDITIONS

A. Verify dimensions by field measurements.

B. Determine suitable path for moving switchboard into place considering project conditions.

C. Verify clearance requirements. Locate switchboard to meet installation tolerances.

D. Revise locations and elevations from those indicated as required to suit project conditions.

1.7 WARRANTY

A. Manufacturer shall warrant equipment to be free from defects in materials and workmanship for the lesser of one year from date of installation or eighteen months from date of purchase.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This design is based on the use of equipment manufactured by Square D Company. Subject to compliance with project requirements, equivalent products by one of the following manufacturers may be considered:

1. Square D Company
2. General Electric Company
3. Eaton
4. Siemens

2.2 PANELBOARDS - GENERAL

A. Panelboards shall be provided as shown on plans and described herein.

B. Panelboard enclosures shall be a minimum of 20” wide and 5.75” deep unless otherwise shown. Panelboards shall be totally flat with flush keyed locks. Enclosures shall be NEMA 1 for panelboards that are installed indoors and NEMA 3R for panelboards that are installed outdoors. Where more stringent panelboard enclosure requirements are specified on the panel schedules, the requirements specified on the panel schedule shall be provided.

C. Fronts shall be cold rolled sheet steel painted with ANSI 61 gray enamel over a rust inhibitor. They shall be equipped with door, flush hinges, and flush proper cylinder tumbler lock, metal circuit card holder, and quarter turn adjustable trim clamps. Panel locks shall be keyed alike.

D. Panel shall consist of reinforced corrosion resistant galvanized sheet steel frame with silver plated copper bus bars and circuit breakers properly supported to prevent vibration breakage in handling. All terminals shall be solderless type suitable for specified conductors of size indicated.

E. Each panelboards shall have a full size neutral bus. The neutral bus shall be 200% rated when supplied from a double neutral feeder. Each panelboards shall also have a full size equipment ground bus. In addition to the equipment ground bus, provide an isolated ground bus when supplied from a feeder which includes an isolated grounding conductor.

F. Branch circuit breakers shall be molded case, bolt-on, and fully interchangeable without disturbing adjacent units. All 2-pole and 3-pole breakers shall have common trips. Circuit breakers supplying Class 1 transformers shall be lockable in the off position.

G. Branch panelboards and overcurrent protection devices shall have a short circuit rating of no less than 10,000 RMS symmetrical AIC (120/208V).

H. Distribution panelboards and overcurrent protection devices shall have a short circuit rating of no less than 42,000 RMS symmetrical AIC (120/208V).

I. All Panelboards shall be fully rated as shown on Drawings; series-rating shall not be allowed.

J. Panelboards shall bear an Arc-Flash Hazard Warning label in accordance with CEC Article 110.16.

K. Breakers for switching lights shall be type SWD, rated for switching duty. Breakers for mechanical equipment shall be HACR type.

L. All spaces shall have hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive panelboards to provide adequate clearance for panelboard installation.

B. Check that working space is level and free of irregularities.

C. Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Panelboards shall have, in addition to conduit shown on the drawings, two ¾” and three 1” conduits stubbed to nearest accessible attic space.

B. Panelboards shall be installed with the top of the trim at 6’-0” above the finished floor, unless otherwise indicated on the drawings.

C. Where space permits, panelboards shall be surface mounted where they are not visible to the public.

D. Panelboards shall have a typewritten circuit directory installed mounted behind plastic in a metal holder that is welded to the inside of each panel door. The type written circuit directory shall show circuit numbers and complete description of all outlets on each circuit and

E. An Arc-Flash Hazard Warning label shall be applied to each panelboard in accordance with CEC 110.16.

F. Labeling of all circuits at panelboards shall match the exact room names of each of the spaces. Verify exact room names with Owner prior to labeling.

G. Electrical loads shall be disaggregated into separate panelboards per the 2022 California Energy Code Section 130.5(b).

3.3 CONNECTIONS

A. Connect panelboards and components to wiring systems and to ground as indicated and instructed by manufacturer.

B. Tighten electrical connectors and terminals, including screws and bolts, according to manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicates, use those specified in UL 786A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Refer to Specification Section 269500, Electrical Acceptance Testing, for minimum required switchboard testing by Contractor and Independent Testing Agency.

3.5 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturer's specifications.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust any circuit breaker trip and time delay settings to values as instructed by the Engineer.

3.6 CLEANING

A. Upon completion of installation, inspect interior and exterior of switchboards. Remove paint spatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 262416

SECTION 265113
LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. The Contractor shall provide, install, connect, commission, test and place into operation a complete lighting system in accordance with the requirements of 2022 California Energy Code, California Code of Regulations Title 24, Part 6, and as herein specified.

B. Basis of Design for lighting system: Lighting systems are primarily based on the use of dimmable LED fixtures as specified herein.

C. Provide lighting fixtures of sizes, types and ratings as indicated by Drawings and Schedules, including, but not limited to, housing, light emitting diode (LED) modules, LED drivers, reflectors, diffusers, emergency lighting units, control components, wiring, accessories, poles, pole bases and mounting hardware.

1.3 DEFINITIONS

A. A Fixture is a complete unit, exit sign, or emergency lighting unit. Fixtures include LED modules or lamps, as specified, and parts required to distribute light, position and protect LED modules, and connect and disconnect LED modules to and from the power supply.

B. An Emergency Lighting Unit is a fixture with integral emergency battery-powered supply and the means for controlling and charging the battery. It is also known as an emergency light set. Emergency lighting units include ones with and without integral LED or lamp heads.

1.4 DESIGNATION

A. Unless otherwise shown on the plans, fixture type designation for an individual fixture shall be typical for similarly indicated fixtures within the entire room or defined area.

B. Unless otherwise shown on the plans, fixtures mounted in a continuous row shall be of the same type as any individually designated fixture within the row.

C. Where a fixture is undesignated on the plans, it shall be of the same type as fixtures of similar function within the room it is located or within similar rooms or areas.

1.5 COORDINATION

A. Confirm compatibility and interface of other materials with luminaires and ceiling system. Report discrepancies to the Architect or Electrical Engineer, and defer ordering until clarified.

B. Supply plaster frames, trim rings, and back boxes to other trades.

C. Coordinate with Division 21-25 to avoid conflicts between luminaries, supports, fittings, and mechanical equipment.

D. All fixtures shall be coordinated with the architectural reflected ceiling plan. If any discrepancies occur, the Architect or Electrical Engineer must be notified in writing before installation is started.

1.6 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Product Data

1. Submit complete list of fixtures and manufacturer's catalog cuts and installation instructions on each type of lighting fixture and component. Include data on LED modules, LED drivers, poles, accessories and finishes. Include details indicating compatibility with ceiling grid system.

2. Submit outline drawings indicating dimensions and principal features of fixtures and poles.

3. Submit manufacturer's data on lighting control equipment and components. Include complete wiring diagrams, with wiring types and any installation limitations.

4. Submit battery and charger data for emergency lighting units.

C. Shop Drawings

1. Submit layout drawings of all non-standard or customized fixtures. Drawings shall include mounting and feed points and methods.

2. Submit wiring diagrams detailing wiring for control system specific to this Project and showing both factory-installed and field-installed wiring, and differentiating between factory-installed and field-installed wiring.

D. Operation and Maintenance Data

1. Submit operation and maintenance data for lighting control devices to include in maintenance manuals specified in Division 01 and Specification Section 260100.

1.7 QUALITY ASSURANCE

A. Nothing in these Drawings or Specifications shall be interpreted as to permit any device, system, or work that is not in compliance with the current California Code of Regulations. Where work is detailed and/or specified to a more restrictive standard or higher requirement, that standard or requirement shall govern such work. Applicable codes and regulations include, but are not limited to, the following:

1. Fixtures and emergency lighting units shall be certified by the manufacturer as meeting efficiency requirements prescribed under the test methods of the current California Code of Regulations Title 20, Appliance Efficiency Regulations.

2. All work, commissioning and testing shall fully comply with the 2022 California Energy Code.

1.8 WARRANTY

A. The Special Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty for Batteries

1. Submit a written warranty executed by the manufacturer agreeing to replace (includes material and labor) rechargeable system batteries that fail in materials or workmanship within the specified warranty period.

2. The Special Warranty Period shall be manufacturer’s standard but not less than 10 years after date of Completion. Full warranty shall apply for first year, and prorated warranty for last 9 years.

C. Special Warranty for Exterior Fixtures

1. Submit a written warranty signed by manufacturer and installer agreeing to replace external parts of lighting fixtures exhibiting a failure of finish within specified warranty period.

2. Failure of finish is defined as perforation or erosion of finish due to weathering or fading, staining, and chalking of finish color due to effects of weather and solar radiation.

3. The Special Warranty Period shall be five years from date of Substantial Completion.

D. Special Warranty for LED Modules and Drivers

1. LED modules and drivers shall be provided with a five year warranty including labor charges for replacement of defective LED modules and drivers.

PART 2 - PRODUCTS

2.1 FIXTURES (GENERAL)

A. The fixtures described in the Lighting Fixture Schedule on the drawings are to be used as a standard of quality to be maintained. Substitute items of same function, performance, and appearance are acceptable in conformance with Section 260100, except where noted otherwise.

B. Provide fixtures complete with all fittings, LED modules, drivers, stems, hangers, and component parts to make a complete installation. Fixtures shall have a suitable interior means of grounding the enclosure.

C. All attaching devices for recessed or surface mounted fixtures mounted in the ceiling shall be of formed or rolled steel and of sufficient strength to prevent movement of fixture after installation.

D. The Architect, Electrical Engineer or Owner shall have the right to reject any damaged fixture, including any fixture with damaged or cracked finishes, broken or bent metal, damaged or broken lenses. Any fixture with an appearance deemed to be abnormal, may also be rejected by the Architect, Electrical Engineer or Owner. Rejected fixtures shall be removed and replaced with an undamaged fixture at no cost to the Owner.

E. Lenses shall be virgin acrylic, 0.125 inches thick minimum, unless otherwise noted.

F. There shall be no visible trademarks or monograms on the lighting fixtures.

G. The Contractor shall provide lay-in frames for all exposed “T” ceiling systems and flanged trims for plasterboard, spline or metal lathe and plaster ceiling systems. The Contractor shall provide plaster or mounting frames where required.

H. Doors, frames, and other internal access shall be smooth operating, free from light leakage under operating conditions, and arranged to permit re-lamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during maintenance and when secured in operating position.

I. Minimum reflectance of reflecting surfaces shall be as follows, except as otherwise indicated:

1. White Surfaces - 85 percent.
2. Specular Surfaces - 83 percent
3. Diffusing Specular Surfaces - 75 percent
4. Laminating Silver Metallized Film - 90 percent

J. Fixtures installed in non-hazardous locations shall conform to UL 1598.

K. Light emitting diode (LED) equipment used in fixtures shall conform to UL 8750.

L. Exposed hardware shall be stainless steel.

2.2 LED FIXTURES

A. LED Modules

1. Color Temperature: 4,000 Kelvin (K)

2. Color Consistency: 2-step MacAdams ellipse

3. Color Rendering:

a. Indoor Fixtures: 90 CRI, or greater

b. Outdoor Fixtures: 70 CRI, or greater

4. Dimming: LED modules shall be compatible with the 0-10VDC dimmable LED driver.

5. Light Distribution: As indicated on Lighting Fixture Schedule

6. Rated Life: 60,000-hours, with 90-percent lumen maintenance at 50-degrees C, in accordance with TM-21-11.

B. LED Drivers

1. LED Drivers shall be 0-10VDC dimmable and shall be compatible with the LED modules and provide the correct 0-10VDC control voltage.

2. LED Drivers shall be independently tested by Intertek and shall bear the ETL Listed Mark as proof of meeting the applicable published safety standards.

3. LED Drivers shall be independently tested and certified by Underwriters Laboratories (UL) to meet FCC Regulations Part 15 and Part 18 and NEMA standards regarding electromagnetic and radio frequency interference, shall bear the United States UL Listed Mark as proof of meeting the applicable published standards.

4. LED Drivers shall comply with ANSI C62.41, Category A and IEEE 587 standards regarding harmonic distortion and surge protection. Total Harmonic Distortion (THD) shall not exceed 20 percent.

5. LED Drivers shall comply with IEC standard 60929, Annex E and shall source no more than 2mA of control current at 0-10VDC.

6. LED Drivers shall be solid-state, electronic, high power factor (minimum 0.9).

7. LED Drivers shall have a Class A sound rating.

8. LED Drivers shall have internal thermal protection to limit driver case temperature to a maximum of 75-degrees C.

9. Ambient Operating Temperature Range: -40-degrees C to 55-degrees C.

10. Rated Frequency: 60-Hertz

11. Rated Life: 60,000-hours

C. Quality Control

1. Testing and measurement of LED lighting fixture performance shall comply with IES LM-79-08 and IES LM-82-12.

2. Testing and measurement of LED and LED module lumen maintenance shall comply with IES LM-80-08.

2.3 NLIGHT ENABLED NETWORK LIGHTING FIXTURES

A. Lighting fixtures specified as nLight enabled shall have an integral nLight network interface and be integrated into the nLight network lighting control system.

2.4 EXTERIOR FIXTURES

A. Metal parts of exterior fixtures exposed to weather conditions shall be constructed of cast or spun aluminum, cast bronze, stainless steel or other nonferrous metals available to withstand exposure.

B. Steel fixtures installed in damp or wet locations shall have zinc-chromate or equal primer.

C. Provide gaskets for all trims and housings.

D. All exterior fixtures shall be supplied by a branch circuit that is controlled by an astronomic time clock that is programmed to automatically turn lights off during daylight hours.

2.5 EXIT SIGNS

A. Exit signs shall conform to UL 924.

B. Sign Colors and Minimum Letter Height shall be per local code.

C. Exit signs shall include arrows as indicated.

D. Exit signs shall have an integral emergency battery pack and shall include an integral automatic charger in a self-contained power pack. Battery shall be sealed, maintenance-free, nickel-cadmium type with special warranty. The charger shall be fully automatic, solid-state type with sealed transfer relay.

E. Lamps for AC operation shall be light emitting diodes with 20,000 hours minimum rated lamp life.

F. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.6 EMERGENCY LIGHTING UNITS

A. Emergency Lighting Units shall conform to UL 924.

B. Emergency Lighting Units shall be self-contained with sealed, maintenance-free, lead-acid type battery with minimum 10-year nominal life and special warranty. Charger shall be minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.

C. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent on nominal voltage or below. The lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery and automatically recharges and floats on trickle charger when normal voltage is restored.

D. Where indicated, provide heavy-chrome-plated wire guard arranged to protect lamp heads or fixtures.

E. Provide time-delay relay in emergency lighting unit control circuit arranged to hold unit ON for fixed interval after restoration of power after an outage. Provide adequate time delay to permit HID lamps to restrike and develop adequate output.

2.7 EMERGENCY LED DRIVERS

A. Emergency LED Drivers shall conform to UL 924

B. Emergency LED Drivers shall be self-contained, modular, battery-inverter unit factory mounted within fixture body. Battery shall be sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life. The charger shall be fully automatic, solid-state, constant-current type.

C. Emergency LED Drivers shall be provided with test switch and LED indicator light visible and accessible without opening fixture or entering ceiling space.

D. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Relay disconnects lamp and battery and automatically recharges when normal voltage is restored.

2.8 EMERGENCY LIGHTING INVERTERS

A. Emergency Lighting Inverters shall be listed to UL 1778 and UL 924 by ETL, and shall be California Title 20 compliant.

B. Emergency Lighting Inverters shall be compact central lighting inverters self-contained in a single cabinet with the following ratings:

1. Available sizes: 375-watt, 750-watt; provide sizes as scheduled on the Drawings.
2. Input Voltage: 277-volt
3. Output Voltage: 277-volt
4. Output Frequency: 60-Hz
5. Output Voltage Regulation: 4%
6. Output Waveform: Sinusoidal during emergency with no greater than 10% total harmonic distortion.
7. Output protection: Current limiting and short circuit protection.
8. Battery: Maintenance free sealed lead calcium.
9. Recharge Time: Recharge time shall comply with UL 924.
10. Dimensions: 24.64”W x 22.1”H x 9.8”D (maximum dimensions)
11. Weight: Weight shall not exceed 232-lbs.

C. Emergency Lighting Inverters shall be rated for the following applications: LED, Incandescent, Fluorescent.

D. Emergency Power inverter shall have the following features:
1. Low profile compact cabinet
2. Single-phase, full range voltage regulation
3. Internal circuit breaker
4. Side panel test switch
5. Monitoring: Side panel LEDs display unit status; alarm indicators

E. Emergency Lighting Inverters shall be Iota IIS-series, sized as scheduled on the Drawings.

2.9 POLES

A. Light standards shall be as specified on the Lighting Fixture Schedule. Where a color is specified a powder coating and over galvanizing finish shall be applied.

B. Poles shall have provisions for bonding to ground and shall be bonded to the equipment grounding conductor run with the supply branch circuit.

2.10 WET AND DAMP LOCATIONS

A. All lighting fixtures installed in damp locations shall have UL approved “wet” or “damp” location labels visible in interior of fixtures.

B. All lighting fixtures installed in wet locations shall have UL approved “wet” location labels visible in interior of fixtures.

PART 3 - EXECUTION

3.1 LIGHTING FIXTURES INSTALLATION

A. Continuous runs of fixtures shall be installed straight and true.

B. All new fixtures shall be securely anchored to prevent any possible chance of their falling.

C. The Contractor shall coordinate outlets with Acoustic Tile Contractor and other trades and locate outlets in center or at intersections of acoustical tile in all acoustical tile ceilings. All fixtures must be kept 1 ½” clear of all acoustic tile and any combustible material by use of approved spacers, unless Fire Underwriters approved to be surface mounted.

D. All fixtures mounted in or on suspended ceilings shall be fastened to the ceiling framing members in accordance with CEC 410.36(B).

E. Recessed fixtures shall be complete with plaster frames, supporting brackets and hanger wires.

F. When lighting fixtures are equipped with integral emergency battery packs the fixtures shall be wired so that all lamps switch on and off via the room light switch and the emergency lamps are automatically energized if the normal power has failed.

G. Install equipment level and plumb and according to manufacturer’s written instructions.

H. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounted devices.

I. Fixture installation shall conform to all applicable standards for installation, mounting, wiring, and quality.

J. All fixtures shall be grounded and bonded in accordance with applicable codes. Where fixtures are installed in rows, a bonding screw shall be used to maintain bonding integrity from fixture to fixture.

K. All fixtures, lenses, and other trim shall be aligned, cleaned, free of paint and blemishes before final acceptance.

L. Fixtures weighing more than 50 pounds shall be supported independent of the fixture box. All outlet boxes shall be able to support a minimum of eight pounds.

M. For fixtures weighting more than two pounds, support shall be provided at all four corners, plus the outlet box. Each support shall be able to carry a minimum of four times its intended load.

N. No support or insert, except pendant canopies, shall be visible from the floor.

O. Where fixtures are pendant suspended, the use of ball aligner and canopies at ceiling and fixture, stem, and other required mounting devices shall be required for installation as required to meet Title 24 requirements. A safety cable anchored to the roof structure shall be installed in all pendants. If any obstruction within the 45 degree swing of the fixture exists, the Contractor shall provide a State approved restraint system to prevent the fixture from swinging into the obstruction.

P. When fixtures are stem mounted, the variation in distance from the finished floor shall vary no more than ½" from the heights as specified on the plans.

Q. Pendant-Mounted fixtures mounting heights shall be to the bottom of the fixture. Mounting heights of the wall-mounted fixtures shall be to the center of the outlet box unless otherwise noted.

R. Provide surface-mounted fixtures with UL approval for direct mounting on the various ceilings, unless specified otherwise. Spacers will not be approved.

S. All fixtures shall be supported directly to building structural members or from bridging attached to the structural members, or shall have positive attached structural angles, and/or all-thread rod extensions from structure to ceiling plane. Fixtures and supports shall be laterally braced independently from suspended ceilings (hard or T-bar) utilizing structural angles at approximate 45° angles in two planes from ceiling plane to structure above. Minimum rod size shall be ½" and minimum angle size shall be ¾" x ¾" x 3/16" unless noted otherwise in specific details. Provide all necessary blocking and hardware so that fixtures hang true, square, plumb, and in proper alignment.

T. Recessed fixtures in T-bar ceilings (CCR Title 24, part 2, Section 1616A.1.20)

1. All light fixtures shall be attached positively to the ceiling suspension systems by mechanical means per CEC Article 410.36 to resist a horizontal force equal to the weight of the fixture. A minimum of two screws or approved fasteners are required at each light fixture, per ASTM E580, Section 5.3.1.

2. Light fixtures weighing less than or equal to 10 lbs shall have a minimum of one #12 gage slack safety wire connected from the fixture housing to the structure above.

3. Light fixtures weighing greater than 10 lbs but less than or equal to 56 lbs may be supported directly on the ceiling runners, but they shall have a minimum of two #12 gage slack safety wires connected from the fixture housing at diagonal corners and anchored to the structure above.

4. Light fixture weighing greater than 56 lbs shall be independently supported by not less than four taut #12 gage wires attached to the housing and to the structure above. The four taut #12 gage wires, including their attachment to structure above, must be capable of supporting four times the weight of the unit.

U. Surface fixtures mounted to T-bar ceilings shall be bolted through ceiling panel to metal channel struts suspended between ceiling main runners. Install hanger wires per above from struts to ceiling.

V. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface.

W. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

X. Installation of Recessed Lighting Fixtures in Accessible-type Suspended Ceilings shall be such that the fixtures will exactly suit the type of ceilings used without altering the fixture or the ceiling. Each fixture shall be wired with a piece of flexible conduit sufficiently long to remove fixture enclosure from ceiling without disconnecting unit. Fixture manufacturer shall prepare drawing or catalog sheets in which all details of fixture installation are carefully analyzed. Contractor to submit these shop drawings for approval. If clearance above “T” bar system is too restricted to “tip-in” fixture, the Electrical Contractor shall coordinate with acoustic ceiling installer by leaving one cross “T” off until the cross “T” shall be secured into its proper place.

Y. Where fixtures are installed in 1-Hour Rated Ceiling, Contractor shall provide gypboard “tents” above the fixtures to maintain the integrity of the 1-hour fire ceiling.

Z. Adjust aimable fixtures to provide required light intensities.

3.2 FIELD QUALITY CONTROL

A. Refer to Specification Section 269500, Electrical Acceptance Testing, for minimum required lighting testing by Contractor.

END OF SECTION 265113

SECTION 266100
LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 SUMMARY

A. The Contractor shall furnish, install, connect, commission, test and place into operation a complete system of lighting control equipment in accordance with the requirements of 2022 California Energy Code, California Code of Regulations Title 24, Part 6, and as herein specified.

B. Basis of Design for lighting control systems: Lighting control systems are primarily based on the use of a networked distributed digital lighting management system for control of indoor lighting systems and astronomic time clock controls for outdoor lighting systems and sign lighting. A BACnet interface shall be provided with the digital lighting management system and shall be integrated to facilitate exterior building lighting control through the energy management system.

C. Provide lighting control equipment as indicated by drawings and schedules, including but not limited to, digital lighting management system dimming equipment, occupancy sensors, daylight sensors (photosensors), astronomic time clocks and multi-pole lighting relays and contactors and wiring.

D. Mandatory Indoor Lighting Controls:

1. Area Controls – Provide area controls in each space to facilitate the manual control of lighting within that space.

2. Multi-level controls – Provide multi-level controls to facilitate the uniform reduction of lighting energy used in each space. Multi-level controls shall be accomplished through dimming.

3. Automatic Shutoff Controls – Provide occupancy sensors in each space to automatically shut-OFF the lighting when the space is unoccupied.

4. Automatic Daylighting Controls – Provide daylight sensors in each daylit area and automatically control lighting fixtures within the daylit areas separately from the fixtures located in non-daylit areas.

5. Demand Responsive Controls – Provide controls that are capable of receiving and automatically responding to a demand response signal.

E. Mandatory Outdoor Lighting Controls:

1. Controls for outdoor lighting – Outdoor lighting shall be controlled by an astronomic time-clock that automatically turns OFF the outdoor lighting when daylight is available.

2. Motion Sensor Controls – Provide a motion sensor control at each outdoor lighting fixture that is located 24-feet or less above the ground; except lighting fixtures rated 40-watts or less.

F. Provide lighting control systems and equipment as indicated on drawings and schedules, including but not limited to, network lighting control system, network ceiling mounted occupancy sensors, network dimming manual control stations, network daylighting sensors (photosensors), network dimming control relays, network plug load control relays, network bridges, network gateways, network automated demand response control interface, network lighting control system integration for nLight enabled lighting fixtures, configuration tools, programming, configuration and documentation software, wall switches with integral occupancy sensors, emergency lighting control devices, astronomic time-switch controls and lighting control panels, photoelectric relays, and multi-pole lighting relays and contactors.

1.3 COORDINATION

A. Confirm compatibility and interface of lighting control equipment with lighting fixtures, LED drivers and ceiling systems. Report discrepancies to the Architect or Electrical Engineer, and defer ordering until clarified.

B. Coordinate with Divisions 21-25 to avoid conflicts between supports, fittings, and mechanical equipment.

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Shop Drawings:

1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.

2. Show exact location of all digital devices, including at minimum sensors, room controllers, and switches for each area on reflected ceiling plans.

3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.

4. Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:

1. Indicates where sensor is proposed to be installed.

2. Prove that the sensor is suitable for the proposed application.

1.5 QUALITY ASSURANCE

A. Nothing in these Drawings or Specifications shall be interpreted as to permit any device, system, or work that is not in compliance with the current California Code of Regulations. Where work is detailed and/or specified to a more restrictive standard or higher requirement, that standard or requirement shall govern such work. Applicable codes and regulations include, but are not limited to, the following:

1. All lighting control devices and systems shall be certified by the manufacturer as meeting the requirements of the current California Code of Regulations Title 20, Appliance Efficiency Regulations.

2. All work, commissioning and testing shall fully comply with the 2022 California Energy Code.

1.6 CODES AND STANDARDS

A. All work and materials shall fully comply with current rules and regulations of all applicable codes. Nothing in these Drawings or Specifications shall be interpreted as to permit any work not in compliance with these codes. Where work is detailed and/or specified to a more restrictive standard or higher requirement, that standard or requirement shall govern such work. Installation shall comply with the following codes and standards:

1. California Code of Regulations (CCR)
   a. Title 8, Industrial Relations
   b. Title 17, Public Health
   c. Title 24, Building Standards
2. 2022 California Building Code.
3. 2022 California Fire Code.
4. 2022 California Electrical Code.
5. 2022 California Energy Code.
6. Local Codes.
7. ANSI/TIA/EIA-568-C-2012 Commercial Building Telecommunications Standard
8. ANSI/TIA/EIA-607-B-2013 Grounding and Bonding Requirements for Telecommunications in Commercial Buildings

9. BICSI TDMM Telecommunications Distribution Methods Manual 12th Edition
10. NEMA VE1 Cable Tray Systems
11. NEMA VE2 Cable Tray Installation Guides
12. UL 467 Grounding and Bonding Equipment.
13. UL 1479 Fire Tests of Through-Penetration Firestops

1.7 WARRANTY

A. The **Warranties** specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Provide five-year manufacturer's warranty on all digital lighting management system room control devices and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This design is based on the use of nLight network lighting controls equipment manufactured by Acuity Brands nLight. Subject to compliance with project and specification requirements, equivalent products by the following manufacturers may be considered if a complete substitution request including shop drawings is submitted and approved prior to bid.

1. Network Lighting Controls nLight
2. Enlighted
3. Encelium

B. System: Network Lighting Controls nLight

2.2 NETWORK CEILING MOUNTED OCCUPANCY SENSOR

A. Network ceiling mounted occupancy sensors shall be dual technology digital passive infrared and microphonic occupancy sensors.

B. Network ceiling mounted occupancy sensors shall include the following features:

1. Communicates with the nLight network;
2. Low voltage auxiliary relay rated 1-amp at 24VAC/VDC with 2#20 AWG wire leads;

3. RJ45 port, RJ45 splitter and Category 5e patch cable;

4. Physical Description: Size: 4.55” diameter, 1.55” deep; Weight: 6oz; Color: Matte White;

5. Mounting: Ceiling Tile / Gypsum board surface, or 3.5” octagonal box, or single-gang handy box;

C. Network ceiling mounted occupancy sensors shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

D. nLight product numbers: nCM PDT 9 RJB AR (in offices and spaces less than 250-square-feet); nCM PDT 10 RJB AR (in corridors and spaces greater than 250-square-feet); nCM PDT 6 RJB AR (only in spaces with ceiling height greater that 15-feet);

2.3 SINGLE-ZONE NETWORK DIMMING MANUAL CONTROL STATIONS

A. Single-zone network dimming manual control stations shall include the following features:

1. Communicates with the nLight network;

2. Two RJ45 ports;

3. Physical Description: Size: 2.74” high, 1.68” wide, 1.63” deep; Weight: 2oz; Color: Matte White;

4. Three buttons: “ON/OFF”; up arrow; and down arrow

5. Mounting: Single-gang, 2-3/4” deep switch box with single gang plaster ring, or multi-gang switch box with multi-gang plaster ring matching the number of control stations where multiple control stations are collocated.

B. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

C. nLight product number: nPODM DX; Coordinate device color with the architect and Owner prior to ordering. Device shall be compatible with wall plates having decora style openings. Provide and install a decora style wall plate matching the switch color at each switch. Provide multi-gang wall plates at multi-gang switch locations.

2.4 FOUR-SCENE NETWORK DIMMING MANUAL CONTROL STATIONS

A. Four-scene network dimming manual control stations shall include the following features:

1. Communicates with the nLight network;

2. Two RJ45 ports;

3. Physical Description: Size: 2.74” high, 1.68” wide, 1.63” deep; Weight: 2oz; Color: Matte White;

4. Eight buttons custom engraved: “ON”; “OFF”; “ENERGY”; “A/V”; “DIM-50%”; “DIM-5%”; up arrow; and down arrow

5. Mounting: Single-gang, 2-3/4” deep switch box with single gang plaster ring, or multi-gang switch box with multi-gang plaster ring matching the number of control stations where multiple control stations are collocated.

B. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

C. nLight product number: nPODM 4S DX; Coordinate device color with the architect and Owner prior to ordering. Device shall be compatible with wall plates having decora style openings. Provide and install a decora style wall plate matching the switch color at each switch. Provide multi-gang wall plates at multi-gang switch locations.

2.5 DIGITAL KEYED SWITCH MANUAL CONTROL STATIONS

A. Digital keyed switch manual control stations shall include the following features:

1. Communicates with the nLight network;

2. Two RJ45 ports;

3. Physical Description: Size: 4” high, 1.3” wide, 1.63” deep; Weight: 2oz; Color: Matte White;

4. Key action: Return-to-center for momentary.

5. Pilot LED’s to indicate on or off status.

6. Mounting: Single-gang, 2-3/4” deep switch box with single gang plaster ring, or multi-gang switch box with multi-gang plaster ring matching the number of control stations where multiple control stations are collocated.

B. Digital keyed switch manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

C. nLight product number: nPOD KEY; Coordinate device color with the architect and Owner prior to ordering. Device shall be compatible with wall plates having decora style openings. Provide and install a decora style wall plate matching the switch color at each switch. Provide multi-gang wall plates at multi-gang switch locations.

2.6 NETWORK DAYLIGHTING SENSORS

A. Network daylighting sensors shall be closed loop photosensors that measure the ambient light in the space and provide automatic dimming daylight harvesting capabilities for any load type connected to the network. Daylighting sensors shall be interchangeable without the need for rewiring.

B. Network daylighting sensors shall include the following features:

1. Communicates with the nLight network;

2. RJ45 port, RJ45 splitter and Category 5e patch cable;

3. LED indicator;

4. Physical Description: Size: 4.55” diameter, 1.55” deep; Weight: 6oz; Color: Matte White;

5. Mounting: Ceiling Tile / Gypsum board surface, or 3.5” octagonal box, or single-gang handy box;

C. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

D. nLight Product Number: nCM ADCX RJB.

2.7 NETWORK DIMMING CONTROL RELAYS

A. Network dimming control relays shall automatically bind the room loads to the connected devices in the space. The quantity of network dimming control relays shall be provided to match the number of control zones required in each space.

B. Network dimming control relays shall be the On/Off/Dimming type and include the following features:

1. Communicates with the nLight network;

2. One 120/240/277VAC, 16-amp, latching lighting relay;

3. Sinks 100mA; 0-10VDC dimmable LED drivers;

4. Two RJ45 ports;

5. LED indicator;

6. Physical Description: Size: 3.38” high x 2.53” wide x 1.83” deep + ½” chase nipple; Weight: 6oz; Color: White;

7. Mounting: Mount to a 5S x 2.5” deep large capacity outlet box;

C. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

D. nLight Product Number: nPP16 (D).

2.8 NETWORK PLUG LOAD CONTROL RELAYS

A. Network plug load control relays shall automatically bind a rooms controlled receptacles loads to the network occupancy sensor in the space.

B. Network plug load control relays shall include the following features:

1. Communicates with the nLight network;

2. One 120-volt, 20-amp, UL general purpose latching relay

3. Two RJ45 ports;

4. LED indicator;

5. Physical Description: Size: 3.38” high x 2.53” wide x 1.83” deep + ½” chase nipple; Weight: 6oz; Color: Blue;

6. Mounting: Mount to a 5S x 2.5” deep large capacity outlet box;

C. Network dimming manual control stations shall be nLight Network Lighting Controls communication compatible and powered through the nLight bus.

D. nLight Product Number: nPP20 PL

2.9 NETWORK BRIDGE

A. The network bridge shall be a linear topology subnet to connect nLight network for centralized control.

B. Network bridge shall include the following features:

1. Communicates with the nLight network;

2. Eight RJ-45 network ports; two Class 2 power supply input terminals;

3. Remotely configurable and upgradeable;

4. Push-button programmable;

5. Green LED indicators for each port;

6. Distributes bus power between ports;

7. Supports up to 128 nLight devices per port;

8. Bridge port identification stickers and commissioning card;

9. Physical Description: Size: 4.90” high x 4.90” wide x 1.05” deep; Color: White;

10. Mounting: Mount to a 4S x 2.125” deep outlet box;

C. Provide and install one PS 150, 150mA, 120/277V power supply at each network bridge mounted to 4S outlet box with the network bridge.

D. nLight Product Number: nBRG 8 KIT

2.10 NETWORK GATEWAY ECLYPSE SYSTEM CONTROLLER

A. The network gateway shall be an nLight Eclypse system controller with linear topology subnet to connect nLight network bridges for centralized control and shall have a touch screen control user interface.

B. Network gateway shall include the following features:

1. Communicates with the nLight network;

2. Two RJ-45 nLight bus ports; one touch screen interface power network port; one Ethernet port; two Class 2 power supply input terminals;

3. Remotely configurable and upgradeable;

4. Push-button programmable;

5. Green LED indicators for each port;

6. Supports up to 128 nLight devices per port;

7. Bridge port identification stickers and commissioning card;

8. Physical Description: Size: 14.25” high x 14.25” wide x 4.00” deep; Color: White;

9. Mounting: Wall mount;

10. One LCD touch screen user interface;

C. Provide and install one PS 150, 150W, 120/277V power supply at each nLight Eclypse System Controller.

D. nLight Product Number: nECY-MVOLT-BAC-ADR-REM-ENC-SEP-GFXK

2.11 NETWORK AUTOMATED DEMAND RESPONSIVE CONTROL INTERFACE

A. Provide and install a network automated demand responsive virtual end node control interface. The network automated demand responsive virtual end node control interface shall receive and automatically respond to OpenADR 2.0a messaging protocol and shall respond by adjusting the peak lighting power demand to 85-percent of maximum lighting power demand.

B. Network automated demand responsive control interface shall include the following features:

1. Communicates with the nLight network;

2. One micro USB power connector; one 10/100 BaseT Ethernet;

3. Physical Description: Size: 1.06” high x 2.76” wide x 3.94” deep; Color: White;

4. Mounting: Wall mount;

C. Provide and install one power supply cord at network automated demand responsive control interface;

D. nLight Product Number: ADR (Open ADR VEN)

2.12 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. Programming shall be provided by the Contractor through a web-based suite of applications that gives the programmer the ability to remotely configure and monitor nLight network luminaires and nLight control devices.

B. The Contractor shall completely program and configure the lighting control system to comply with 2022 California Energy Code requirements.

C. Provide one nCOMKIT and commissioning tool interface;

D. Communication Protocol: Programming software shall communicate with nGWY2 over LAN IP network and with nLight network directly through nCOMKIT and commissioning tool interface and shall be able to program up to 20,000 network controlled devices.

E. System Requirements: Laptop or PC with Windows 7 or newer operating system; 4GB RAM and 2GB minimum available memory; Internet Explorer 10 and newer, Chrome, or Firefox browsers.

F. Acuity Controls Product Number: SensorView 13, nCOMKIT

2.13 WALL SWITCH WITH INTEGRAL OCCUPANCY SENSOR

A. Wall switches with integral occupancy sensors shall be comprised of an all digital, passive infrared technology (PIR) sensor to detect human presence.

B. System shall have field selectable auto-ON or manual-ON operating modes and shall be factory set to the manual-ON operating mode.

C. Wall switches with integral occupancy sensors shall be rated: 120/277-volt; 60Hz and shall have separate neutral and equipment grounding connection wire leads.

D. Wall switches with integral occupancy sensing shall be Sensor Switch model WSX (in Janitors closets and storage rooms having only one lighting fixture).

2.14 CONTACTORS AND AUXILIARY RELAYS

A. Contactors and relays shall comply with NEMA ICS 2.

B. Devices are electrically operated and mechanically held. Number of poles and ratings are as indicated. Coordinate rating of each unit with type of load served, including tungsten filament and inductive-type loads.

C. Modular Single-Pole Relays shall be split-coil, momentary-pulsed type, knockout mounting.

1. Low-Voltage Leads: 5-pin plug connector.

2. Pilot Contacts: Single pole.

3. Rated Capacity: 20A, 125VAC for 120-volt lighting loads, and 20A, 277VAC for 277-volt lighting loads.

4. Endurance: 50,000 cycles at rated capacity.

2.15 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a circuit providing normal lighting to an area. The unit provides normal dimming and ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

1. 120/277 volts, 50/60 Hz, 20 amp dimming LED driver rating

2. Push to test button

3. Auxiliary contact for remote test or fire alarm system interface

B. nLight Product Numbers: nPP16 ER SHUNT.

2.16 NLIGHT ENABLED NETWORK LIGHTING FIXTURES

A. Lighting fixtures specified as nLight enabled shall have an integral nLight network interface and be integrated into the nLight network lighting control system.

2.17 LIGHTING CONTROL PANEL

A. The lighting control panels shall be the nLight network connected 8-relay cabinet including the following features:

1. Communicates with the nLight network;

2. Eight 20-amp relays rated for 277-volts; able to separately switch up to eight 120/277 VAC loads.

3. Eight 0-10VDC dimming outputs

4. Two RJ45 ports

5. Integrated power supply for nLight bus and auxiliary device power;

6. Heavy duty terminal blocks;

7. Push button programming;

8. NEMA 1 Enclosure;

9. Physical Description: Size: 14.45” high x 14.41” wide x 4.05” deep; Weight: 12lbs. Color: White;

10. Mounting: Wall mount;

B. nLight Product Numbers: nLight Relay Panel model ARP INTENCO8 NLT 8FCR MVOLT 1VB HLK SM

PART 3 - EXECUTION

3.1 PRE-INSTALLATION MEETING

A. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:

1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.

2. Review the specifications for low voltage control wiring and termination.

3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

4. Discuss requirements for integration with other trades.

3.2 INSTALLATION, CALIBRATION AND PROGRAMMING SERVICES

A. Install all devices and wiring in a professional manner. All line voltage connections shall be tagged to indicate circuit and switched legs.

B. Category 5e network cables shall not have boots installed at the RJ45 plug connectors.

C. Provide and install category 5e cable with RJ-45 connectors interconnecting all control device, bridges and gateways. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufacturer with test results. Low voltage wiring topology must comply with manufacturer's specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.

D. Provide and install one ¾" conduit with 2#12 copper THWN/THHN + 1#12 copper ground between nearest constant hot portion of lighting branch circuit and each PS 150 power supply. Connect line voltage to each power supply and connect the Class 2 low voltage wiring between the PS 150 power supply and network bridge.

E. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, the contractor shall test all devices to ensure proper communication.

F. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

G. Adjust time delay so that controlled area remains lighted while occupied.

H. Provide written or computer-generated documentation on the configuration of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.

2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

3. Load Parameters (e.g. blink warning, etc.)

I. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

J. Network daylight sensors for automatic dimming within a daylit zone shall be calibrated such that lighting power for the lighting fixtures within that daylit zone shall be reduced by 65% when daylit illuminance is 150% of design illuminance. Design illuminance for specific spaces shall be as recommended by the IESNA Lighting Handbook 8th Edition Chapter 11, Figure 11-1, for Commercial, Institutional, Residential, and Public Assembly Interiors.

K. Program uniform manual dimming and ON-OFF control within each space that has a network daylight sensor:

1. Lighting fixtures located within daylit zones shall be programmed to manually turn ON and OFF with lighting fixtures located outside of the daylit zones (in the same space) with a common ON/OFF button.

2. Lighting fixtures located within daylit zones shall be programmed to manually dim at the same rate as lighting fixtures outside of the daylit zone (in the same space) once lighting fixtures outside of the daylit zone have had lighting power manually reduced by 65%.

L. Program four-scene network dimming manual control stations as follows:

1. ENERGY SAVER (Scene 1): Selection of the "ENERGY SAVER" scene shall uniformly lower the lighting levels of all lighting fixtures within the space to 85-percent of their maximum lighting power demand (emulates demand response at local zone level).

2. A/V (Scene 2): Selection of the "A/V" scene shall turn OFF lighting fixtures in zones with lighting fixtures located in front of a projection screens or video monitors and shall reduce all other zones within the space to 20-percent of maximum light output.

3. DIM-50% (Scene 3): Selection of the "DIM-50%" scene shall uniformly lower the lighting levels of all lighting fixtures within the space to 50-percent of maximum light output.

4. DIM-5% (Scene 4): Selection of the "DIM-5%" scene shall uniformly lower the lighting levels of all lighting fixtures within the space to 5-percent of maximum light output.

5. Dimming manual control station shall include ON/OFF control.

M. Lighting controls shall be connected and programmed to be demand responsive and shall automatically reduce building lighting power demand by 15% in response to a demand response signal per 2022 CA Energy Code section 130.1 (e).

3.3 FACTORY SERVICES

A. Upon completion of the installation, a manufacturer's factory authorized representative shall start up and verify a complete and fully functional system.

B. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.4 ACCEPTANCE TESTING AND COMMISSIONING

A. The Contractor shall provide the services of a California State certified lighting controls acceptance test technician (CLCATT) to act as the acceptance testing agent and verify the installation of the lighting control systems.

B. Provide the services of a manufacturer’s factory technician time to assist the CLCATT review the functionality and settings of the lighting control hardware per the requirements in the California State forms.

C. The Contractor shall provide the services of a Commissioning Agent to provide commissioning of the indoor and outdoor lighting systems. The following commission tasks shall be completed in accordance with 2022 California Energy Code, Section 120.8 Building Commissioning:

1. The Commissioning Agent shall obtain the Owner’s Project Requirements.

2. The Commissioning Agent shall compile and update a Basis of Design during the construction of the project.

3. The Commissioning Agent shall complete a commissioning plan including the following information:

    a. General project information

    b. Commissioning goals

    c. Systems to be commissioned

    d. Plans to test systems and components, which shall include:

        1) An explanation of the original design intent

        2) Equipment and systems to be tested, including the extent of the tests

        3) Functions to be tested

        4) Conditions under which the test shall be performed

        5) Measurable criteria for acceptable performance

        6) Commissioning team information

7) Commission process activities, schedules and responsibilities

4. The Commissioning Agent shall provide function performance testing.

5. The Commissioning Agent shall provide system documentation and training requirements.

6. The Commissioning Agent shall provide a commissioning report.

3.5 TITLE 24 - PART 6 DOCUMENTATION OF INSTALLATION AND ACCEPTANCE FOR INDOOR AND OUTDOOR LIGHTING

A. The Contractor shall prepare and submit the following Certificates of Installation:

1. Indoor Lighting:

a. Certificate of Installation – Validation of Certificate of Compliance (NRCI-LTI-01-E)

b. Certificate of Installation – Energy Management Control System or Lighting Control System (NRCI-LTI-02-E)

c. Certificate of Installation – Line-Voltage Track Lighting (NRCI-LTI-03-E)

d. Certificate of Installation – Two Interlocked Lighting Systems (NRCI-LTI-04-E)

e. Certificate of Installation – Power Adjustment Factors (NRCI-LTI-05-E)

f. Certificate of Installation – Additional Videoconference Studio Lighting (NRCI-LTI-06-E)

2. Outdoor Lighting:

a. Certificate of Installation – Outdoor Lighting (NRCI-LTO-01-E)

b. Certificate of Installation – EMCS – Lighting Control System (NRCI-LTO-02-E)

3. Sign Lighting:

a. Certificate of Installation – Sign Lighting (NRCI-LTS-01-E)

B. The Contractor shall provide the services of a California state certified lighting controls acceptance test technician (CLCATT) to perform acceptance tests, prepare Certificates of Acceptance and certify that all indoor and outdoor lighting systems comply with the 2022 California Energy Code Section 130.4. The Certificates of Acceptance shall bear the name and certification identification number of the certified lighting compliance acceptance test technician. The certified lighting compliance acceptance test technician shall prepare and submit the following Certificates of Acceptance:

1. Indoor Lighting:

a. Certificate of Acceptance – Lighting Controls (NRCA-LTI-02-A)

b. Certificate of Acceptance – Automatic Daylighting (NRCA-LTI-03-A)

c. Certificate of Acceptance – Demand Responsive Lighting Controls (NRCA-LTI-04-A)

2. Outdoor Lighting:

a. Certificate of Acceptance – Outdoor Motion Sensor and Lighting Shut-off Controls (NRCA-LTO-02-A)

C. The Contractor shall properly calibrate all lighting control devices and systems. To verify that the lighting control devices and systems have been properly calibrated the Contractor shall conduct tests referred to in Chapter 13 of the 2022 California Energy Commission Nonresidential Compliance Manual and required by 2022 California Energy Code Article 130.4. The Contractor shall test and make modifications to the control until it passes the test in accordance with the following Reference Non-Residential Appendices:

1. Indoor Lighting:

a. NA7.6.1 Automatic Daylighting Controls Acceptance

b. NA7.6.2 Shutoff Controls Acceptance

c. NA7.6.3 Demand Responsive Lighting Controls Acceptance

d. NA7.6.5 Demand Responsive Controls for Controlled Receptacles Acceptance

2. Outdoor Lighting

a. NA7.8 Outdoor Lighting Controls

3.6 ON-SITE ASSISTANCE

A. Within one year of date of Substantial Completion, provide up to three Project site visits, when requested, to adjust light levels, make program changes, and adjust sensors and controls to suit actual conditions.

3.7 PERSONNEL TRAINING

A. Train Owner’s building personnel in procedures for starting-up, testing and operating lighting control system equipment.

END OF SECTION 266100

SECTION 269500
ELECTRICAL ACCEPTANCE TESTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section defines the Electrical Acceptance Tests and checks that shall be made on all electrical equipment and wiring to ensure compliance with all applicable Codes and Standards, and with the requirements of the Contract Documents.

B. All electrical equipment testing and related costs shall be included in the Contractor's bid.

1.2 GENERAL REQUIREMENTS

A. The Contractor shall test equipment of all kinds installed on this project to determine whether it fulfills the requirements of these Specifications. The Contractor shall furnish all labor necessary to adjust the operation of the apparatus and make the connections for the tests. After the tests have been completed, the Contractor shall restore all connections, apparatus, etc., to their original condition.

B. The Contractor shall retain the services of a qualified Independent Testing Agency holding a valid current C-10 License to perform **certain** tests and prepare reports, as enumerated in the following Articles. The Independent Testing Agency shall be a company that specializes in electrical equipment testing and shall be NETA or NICET certified.

C. The contractor shall obtain approval from the architect of proposed independent testing agency(s) before any testing is started.

D. Electrical systems, equipment and materials shall be tested prior to final acceptance of the work.

1.3 INDEPENDENT TESTING AGENCY REQUIREMENTS

A. The Independent Testing Agency shall furnish personnel acceptable to Engineer to conduct testing. Supervising engineer shall have a minimum of five years' experience in testing of equipment of the type to be tested on this Project.

B. The Independent Testing Agency shall furnish all labor required for and incidental to testing.

C. The Independent Testing Agency shall provide minor field repairs, adjustments, and wiring modifications at the time of inspection and testing.

D. The Independent Testing Agency shall furnish all necessary test equipment to satisfactorily perform all tests specified herein.

E. The Independent Testing Agency shall check all devices for proper operation - checking for wear, tightness, dirt, etc.

F. The Independent Testing Agency shall check for conformance to published curves.

G. The Independent Testing Agency shall notify and coordinate with the Owner's representative at least 3 working days prior to the commencement of any Electrical Acceptance Testing. Tests shall be witnessed by the Owner's representative unless such witnessing is waived in writing by the Owner's Representative.

1.4 CODES AND STANDARDS

A. 2022 California Electrical Code (CEC).

B. National Electrical Manufacturer's Association (NEMA).

C. Manufacturer's Instructions and Maintenance Manual applicable to each particular apparatus.

D. OSHA Rules and Regulation.

E. National Electrical Testing Association (NETA) "Acceptance Testing Specifications".

F. Procedures as directed by Engineer.

1.5 CARE AND PRECAUTIONS

A. Contractor shall be responsible for any damage to equipment or material due to improper test procedures or test apparatus handling, and shall replace or restore to original condition, any damaged equipment or material.

B. Contractor shall furnish and use safety devices such as rubber gloves and blankets, protective screens, barriers, and danger signs to adequately protect and warn all personnel in the vicinity of the tests.

1.6 EQUIPMENT TO BE TESTED BY CONTRACTOR

A. Perform the visual inspections, manual operations and tests on systems and equipment as described in Part 3, "Execution".

B. Switchboard and Panelboards

C. Molded Case Circuit Breakers Rated Less Than 100A

D. Power Cable

E. Transformers

F. Service, Distribution and Motor Control Equipment

G. Disconnect Switches

H. Motors

I. Lighting

J. Title 24 Acceptance Testing

K. Control Cable

L. Fire Alarm System

M. Telecommunication System Cabling

1.7 EQUIPMENT TO BE TESTED BY INDEPENDENT TESTING AGENCY

A. Circuit Breakers Rated 100A and Greater

B. Grounding System

1.8 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Test Reports

1. Provide written test reports, signed and dated, for all tests prior to acceptance of the tested equipment by the Owner.

2. All tests shall be recorded on the following forms:

a. 269500 - 1 MULTIPLE CONDUCTOR CABLE MEGGER TEST, 300V AND LESS

b. 269500 - 2 SINGLE & MULTIPLE CONDUCTOR POWER CABLE MEGGER TEST, 600V AND LESS

3. Submit certified reports of Independent Tests and Observations indicating and interpreting test results specified in Part 3 of this Section.

a. The Test Report shall include the following:

1) Description of equipment tested.

2) Description of test procedure.

3) Calibration record for all testing devices used.

4) Test results.

5) Recommendations.

6) Appendix, including all field test reports.

b. Furnish six copies of completed report to the Electrical Engineer no later than ten days after test completion unless requested otherwise by Owner.

c. Instrumentation-Traceability: The testing agency shall provide calibration labels for all relays and circuit breakers tested.

d. Labels shall be self-adhesive and placed on covers or frames so as not to obscure nameplate, tap block or time dial. Label shall indicate date tested and firm name.

PART 2 - PRODUCTS

2.1 TESTING EQUIPMENT

A. Furnish suitable electrical instruments including voltmeters, ammeters, wattmeters, tachometers and all other equipment necessary to perform tests specified.

B. Make necessary openings in circuits for testing instruments and place and connect all instruments, equipment and devices necessary for the tests. Upon completion of tests, remove instruments and instrument connections and restore all circuits to permanent condition.

2.2 TESTING COORDINATION

A. Coordinate activities and cooperate with others on the Project to ensure that systems are energized when required, when loads are applied, and that other requirements of this Section of the Specifications are carried out in a timely, coordinated basis.

B. Conduct tests in the presence of the Construction Manager. Notify the Construction Manager seven calendar days or more in advance when any test is to be performed, and do not start tests without the permission of the Construction Manager.

C. Make up no permanent connections until correct phase sequence of all equipment is determined.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall provide Acceptance Testing on the entire Electrical System. Certain of this testing shall be performed by an Independent Testing Agency as indicated.

B. Acceptance Testing shall include Visual Inspections, Manual Operations, Electrical Tests, and Functional Testing.

C. Whenever possible, all Visual Inspections, Manual Operations and Electrical Tests shall be made just prior to energizing the equipment or circuits, and shall be coordinated with the field schedule and field conditions.

D. Test reports on megger, dielectric absorption and high potential tests shall include the ambient temperature and relative humidity existing at the time of the tests.

E. Should any piece of apparatus or any material or work fail during any of these Tests, it shall be immediately removed and be replaced by perfect material by this Contractor at his expense and the portion of the work replaced be again tested by the Contractor.

F. Before testing and energizing a system, all necessary precautions shall be taken to ensure the safety of personnel and equipment. All conductors and all electrical equipment shall be properly insulated and enclosed. All enclosures for conductors and equipment shall be properly grounded. Insulation resistance measurements must have been made and approved on all conductors and energized parts of electrical equipment.

    1. During actual testing, the Contractor or Independent Testing Agency shall:

        a. Ensure that temporary power terminations are connected in such a manner that commercial power may be restored in forty-five minutes upon request.

        b. Place temporary power cables out of the way in a safe manner that provides no hazard to personnel or equipment in the area.

        c. Provide all special connections required.

        d. Conduct all tests in presence of the representative except where advised this would not be necessary.

G. The entire installation shall be free from short circuits and improper grounds. Panels and circuits shall be tested for grounds and shorts with mains disconnected from the feeder, branches connected, lamps removed or omitted from the sockets and all wall switches closed. Each individual circuit shall be tested at the panel with the equipment connected for proper operation

H. The following minimum tests are required, but shall not be limited to this list. Tests will be supervised and witnessed by the Construction Manager:

    1. Proper phase rotation.

    2. Short circuits.

    3. Improper grounds.

    4. Power and control electrical circuits for circuit continuity and function test.

I. Furnish all personnel, labor, meters, instruments, cable, connections, equipment and apparatus necessary for making all tests.

J. Check and test all switchboards, transformers, panelboards, feeders, power and control cables, communication system devices and wiring, and all connections to all equipment.

K. After wires and cables are in place and connected to devices and equipment, the system shall be tested for short circuits, improper grounds, and other faults. If fault condition is present, the trouble shall be rectified and the wiring system shall be retested.

L. A voltage test shall be made at each lighting panel, distribution panel and at the last outlet on each circuit. If drop in potential exceeds one percent, correct the condition by locating the ground or high resistance splice or connection and retest.

M. Any wiring device, electrical apparatus, or lighting fixture grounded or shorted on any integral "live" part, shall be removed and the trouble rectified by replacing the defective parts or materials.

N. All final tests shall be witnessed by the Construction Manager and three copies of the verified test results shall be given to the Architect/Engineer and Construction Manager promptly upon completion of a test.

O. Provide assistance to the various equipment manufacturers' field engineers as required in the testing and adjusting of the electrical power and control equipment. Cooperation shall be such that a minimum of time is required for equipment testing.

P. A log shall be maintained for all tests. This log shall be certified before completion of the project, both as to test value and date of test. All major equipment such as the switchboard and panelboards shall be energized initially in the presence of the Construction Manager.

Q. The Owner reserves the right to operate any system or equipment prior to final completion and acceptance of the work. Such preliminary operation shall not be construed as an acceptance of any work. Each piece of equipment and all of the systems shall be adjusted to insure proper functioning and shall be left in first class operating condition.

3.2 VISUAL INSPECTIONS

A. Prior to Manual Operation and Electrical Testing, perform Visual Inspections to verify the following:

1. The equipment is completely and properly installed.
2. The equipment is free from damage and defects.
3. Shipping blocks and restraints have been removed.
4. Electrical terminations have been properly tightened.
5. The equipment has been properly aligned.
6. The equipment has been properly lubricated.
7. The ventilation louvers are open and unobstructed.
8. Voltages and phases have been properly identified.

9. Terminations in control panels have been properly identified.

10. The equipment is ready to be tested

3.3 MANUAL OPERATION

A. Prior to any Electrical Testing, mechanical devices shall be exercised or rotated manually to verify that they operate properly and freely.

3.4 ELECTRICAL TESTS BY CONTRACTOR

A. Switchboard and Panelboards

1. The Contractor shall perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification, Sections 7.1, 7.6, 7.9, 7.10, 7.11, and 7.14, as appropriate. Certify compliance with test parameters.

2. Switchboard and completed installation shall be inspected for adequate size, bus spacing, bracing, physical damage, proper alignment, anchorage and grounding.

3. Switchboard frame will be inspected for alignment, level, and anchorage.

4. Check tightness of accessible bolted bus joints using calibrated torque wrench per manufacturer's recommended torque value. All bus bolts will be torqued to their proper value. A mark to be placed on each tightened bolt to ensure completeness.

5. Switchboard interior will be vacuumed and wiped clean.

6. The following tests and checks shall be performed before placing in operation:

   a. Check all new bus and cable connections for proper contact pressure and mark each bolt with a red "dot" of paint to indicate it has been checked.

   b. Check all the new equipment for mechanical adjustment, lubrication, and freedom of operation. Remove all shipping blocks.

   c. Operate and test trip units for all new breakers.

   d. Test all transfer switches and associated control circuits for correct connection and operation.

   e. Test all panel feeders and main breakers.

   f. Test ground fault systems by operating push-to-test button.

   g. Physically test key interlock systems to check for proper functionality.

7. Using a Megger, measure the insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each, at minimum test voltage of 1000VDC. Minimum acceptable value for insulation resistance is one (1) megohm. Refer to manufacturer's literature for specific testing procedure.

8. After Substantial Completion, but not more than 2 months after Final Acceptance, The Contractor shall perform an infrared scan of each switchboard and panelboard.

    a. Remove fronts to make joints and connections accessible to a portable scanner.

    b. Use an approved infrared-scanning device designed to measure temperature or detect significant deviations from normal values.

    c. Provide calibration record for device used.

    d. Prepare a certified report identifying switchboards and panels checked and describing results of infrared scanning. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

B. Molded Case Circuit Breakers rated less than 100A

1. Circuit breakers will be operated manually several times to ensure smooth operation.

2. Molded case will be inspected for cracks.

3. Rated current will be passed through each phase and millivolt readings taken across contacts.

4. Time current characteristic tests will be performed by passing 300% rated current through each phase and monitoring trip time.

5. Instantaneous pickup current will be determined by finding the current level at which the breaker trips out in less than 2 cycles.

6. Insulation resistance tests will be performed at 1000 Volts DC.

7. Circuit breaker covers will be removed on unsealed units and checked for cracks. Interphase barriers and arc chutes to be inspected. All bolts and lugs will be tightened. All internal auxiliary devices will be inspected.

8. Contacts, shunts, etc., will be visually inspected for wear and alignment.

9. Inverse trip time, instantaneous pickup current and millivolt drop across contacts, insulation resistance values, as well as deficiencies causing breaker to function outside published limits will be recorded. Times will then be compared with manufacturer’s or NEMA published values.

C. Power Cable

1. The 600-volt insulated wires and cables shall be factory tested prior to shipment in accordance with ICEA Standards for the insulation specified.

2. Perform a continuity check and a 1,000 volt DC megger test on 600 volt power cables No. 6 AWG and larger.

    a. The megger test shall be performed between each pair of conductors and from each conductor to ground.

b. The megger test shall be performed for 15 seconds or until the insulation resistance value stabilizes.

c. The insulation resistance between conductors and from each conductor to ground shall be 100 megohms minimum in one minute or less. In addition, the lowest insulation resistance value shall not differ from the highest value by more than 20 percent.

3. Phase conductors, if shorted, grounded or at fault shall be removed, shall be replaced and the wiring system shall be retested.

D. Transformers

1. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 2.5 percent. Submit recording and tap settings as test results.

2. Adjust buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

3. Prepare a written Output Settings Report recording output voltages and tap settings.

E. Service, Distribution and Motor Control Equipment

1. Megger tests shall be performed at a DC voltage of 1,000 volts for 600 volt rated equipment, and at 500 volts for 120-300 volt rated equipment.

2. Perform a 1,000-volt megger test on buses, motor starters and disconnect switches. This test may be combined with the feeder cable megger test by testing the devices and terminated cables together.

3. Perform a continuity check on motor control circuits and control panel internal wiring.

4. Perform an operational test on the controls.

5. Perform a continuity check and a 1,000-volt DC megger test on 3 phase distribution and isolation transformers.

F. Disconnect Switches

1. Check for cleanliness of contacts, operation, etc.

2. Lubricate contacts and mechanical devices.

3. Check fuse-clip tightness.

4. Perform a 1,000-volt megger test on disconnect switches rated for 600V and at 500 volts for disconnect switches rated for 240V.

G. Motors

1. Perform a 1,000-volt megger test on 460 volt, 3 phase motors, and a 500 volt megger test on 200-230 volt, 3 phase motors.

2. “Bump” motors to verify proper direction of rotation.

3. Run motors and check for vibration and overheating.

H. Lighting

1. Upon completion of installation of lighting fixtures and controls, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. The Contractor shall replace at his expense all noisy ballasts, broken or cracked lenses or other defective items. Where possible, correct malfunctioning units at site, then re-test to demonstrate compliance; otherwise, remove and replace with new units, and proceed with re-testing.

2. At the time of substantial completion, replace lamps in interior lighting fixtures, which are observed to be noticeably dimmed after Contractor’s use and testing, as judged by Architect or Electrical Engineer.

3. Replace defective and burned out LED fixtures for a period of one-year following the time of substantial completion.

4. Give advance notice of dates and times for field tests.

5. Provide instruments to make and record test results.

6. Tests and Observations

a. Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source.

b. Check for excessively noisy ballasts.

c. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following information in tests of emergency lighting equipment:

1) Duration of supply

2) Low battery voltage shutdown.

3) Normal transfer to battery source and retransfer to normal.

4) Low supply voltage transfer.

5) Report results of tests in wiring.

I. Title 24 Acceptance Testing

1. Perform tests as outlined in Part 3 of Specification Section 266100.

J. Control Cable

1. Perform a continuity check on control and instrumentation wiring.

K. Fire Alarm System

1. Perform testing in accordance with NFPA 72-2022.

L. Special Systems

1. Security and access control systems, sound reinforcement systems, and other special systems shall be tested in accordance with test plans submitted by their manufacturers and approved by the Owner. These test plans shall verify compliance with Specifications and proper operation including all inputs, outputs and accessories under all modes of operation.

M. Telecommunication System Cabling

1. Refer to Division 27 Sections of these Specifications for testing.

3.5 INDEPENDENT AGENCY TESTING

A. Circuit Breakers rated 100A or greater

1. All circuit breakers, 100 amps or more, shall be tested by an independent testing agency in accordance with NETA specifications and a report submitted to the architect. Any circuit breaker that does not pass the test shall be replaced.

2. Circuit breakers will be operated manually several times to ensure smooth operation.

3. Molded case will be inspected for cracks.

4. Rated current will be passed through each phase and millivolt readings taken across contacts.

5. Time current characteristic tests will be performed by passing 300% rated current through each phase and monitoring trip time.

6. Instantaneous pickup current will be determined by finding the current level at which the breaker trips out in less than 2 cycles.

7. Insulation resistance tests will be performed at 1000 Volts DC.

8. Circuit breaker covers will be removed on unsealed units and checked for cracks. Interphase barriers and arc chutes to be inspected. All bolts and lugs will be tightened. All internal auxiliary devices will be inspected.

9. Contacts, shunts, etc., will be visually inspected for wear and alignment.

10. Inverse trip time, instantaneous pickup current and millivolt drop across contacts, insulation resistance values, as well as deficiencies causing breaker to function outside published limits will be recorded. Times will then be compared with manufacturer’s or NEMA published values.

11. The testing agency shall provide calibration labels for all relays and circuit breakers tested. Labels shall be self-adhesive and placed on covers or frames so

as not to obscure nameplate, tap block or time dial. Label shall indicate date tested and firm name.

B. Grounding System

1. Test shall be performed for every new **SEPARATELLY DERIVED AC SYSTEM.**

2. Ground tests shall meet the requirements of the California Electrical Code and comply with UL 467. The grounding electrode system at the main electrical service equipment shall be tested by an Independent Testing Agency in accordance with the three point fall of potential method as specified in IEEE Standard 81-1983. A copy of the test report shall be submitted to the architect and engineer of record.

3. Maximum grounding to resistance values are as follows:

   a. Equipment Rated 500 kVA and Less: 5 ohms.

   b. Equipment Rated 500 to 1000 kVA: 5 ohms.

4. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.

5. The test agency shall remove the test link between the ground and neutral, and test the neutral for any parallel and/or superfluous ground paths. If any are found, a report should be given to the Engineer. No grounds are to be removed unless authorized in writing.

6. Ground electrode resistance shall be taken using a Biddle ground resistance meter and readings given to the report.

7. All ground connections in switchboard as well as that to cold water pipes shall be check for tightness and adequacy.

8. Measure the resistance to ground of each ground rod [in a ground mat] before connection to the other ground rods. The resistance shall not exceed 10 ohms.

9. Measure the resistance to ground of the total ground system with all connections completed. The resistance shall not exceed 2 ohms for primary services or 5 ohms for secondary services.

10. Tests of the resistance to ground shall be made using either the three point method or the fall-of-potential method.

11. Perform a continuity check from equipment ground bus bars and ground lugs to the ground system.

12. Ground rods for manholes and light poles need not be tested.

13. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

14. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.6 FUNCTIONAL TESTING

A. All automatic and manual functions shall be checked for proper operation.

B. All indicating circuits, lights and alarms shall be tested for correct operation. Burned out indicators shall be re-lamped.

C. Upon completion of the Work, place the entire installation in operation, test for proper function, and show systems and equipment to be free of defects.

END OF SECTION 269500

FORM 269500 – 1

MULTIPLE CONDUCTOR CABLE MEGGER TEST, 300 VOLTS & LESS

WIRING - SIGNAL & COMMUNICATION CABLE

Testing shall be performed before connecting the cables to the terminals at either end. Continuity of each conductor shall be checked at this time. Each conductor shall be checked with a 500 volt megger to ground, with all other conductors in the cable and shield, grounded. The minimum acceptable megger resistance shall be 50 megohms for each conductor to ground.

PROJECT NAME _____

FEEDER NUMBER _____ LOCATION _____

CABLE SIZE _____ CABLE LENGTH _____

NO. OF CONDUCTORS _____ INSULATION TYPE _____

MANUFACTURER _____ LINE VOLTAGE _____

TEMPERATURE _____ HUMIDITY _____

MEGGER TYPE _____ SERIAL NUMBER _____

TEST VOLTAGE _____ MULTIPLIER _____

REMARKS _____

CONDUCTOR NO.	MEGOHMS		CONTINUITY		CONDUCTOR NO.	MEGOHMS		CONTINUITY	
	C/C	C/S	PASS	FAIL		C/C	C/S	PASS	FAIL

TEST PERFORMED BY _____ _____
Signature Date

TEST WITNESSED BY _____ _____
Signature Date

FORM 269500 – 2

SINGLE & MULTIPLE CONDUCTOR POWER CABLE MEGGER TEST, 600 VOLTS & LESS

WIRING – FEEDER CIRCUITS

Testing shall be performed before connecting the cables to the terminals at either end. Continuity of each conductor shall be checked at this time. Each conductor shall be checked with a 500-volt megger to ground, with all other conductors (including shield) in the conduit or cable grounded. The minimum acceptable megger resistance shall be 50 megohms for each conductor to ground.

PROJECT NAME _____

FEEDER NUMBER _____ LOCATION _____

CABLE SIZE _____ CABLE LENGTH _____

NO. OF CONDUCTORS _____ INSULATION TYPE _____

MANUFACTURER _____ LINE VOLTAGE _____

TEMPERATURE _____ HUMIDITY _____

MEGGER TYPE _____ SERIAL NUMBER _____

TEST VOLTAGE _____ MULTIPLIER _____

REMARKS _____

Cable No	MEGOHMS Phase A	MEGOHMS Phase B	MEGOHMS Phase C

TEST PERFORMED BY _____ _____
Signature Date

TEST WITNESSED BY _____ _____
Signature Date

SECTION 270000
COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. This project requires the Contractor to furnish, label, test, document, and warrant a Structured Cabling System (SCS) in conformance with this specification for the facilities of the College of the Sequoias (COS) referenced as University Center.

B. Construction drawings and all provisions of other Contract Divisions, issued in conjunction with this specification, shall apply to this Division 27 specification. Coordination of work and resolution of conflicts between project documents issued by others such as Architects, Civil Engineers, Electrical/Mechanical Engineers, Plumbing Engineers, Civil Engineers, etc. and this Division 27 specification with its conjoined construction drawings shall be the responsibility of the Contractor.

C. The list of Division 27 section specifications that may be included as part of this Division 27 specification set includes, but is not limited to, the following:

1. Section 27 06 00 - Schedules for Communications
2. Section 27 05 26 - Grounding and Bonding for Communications Systems
3. Section 27 11 00 - Communications Equipment Room Fittings
4. Section 27 11 13 - Communications Entrance Protection
5. Section 27 11 16 - Communications Cabinets, Racks, Frames, and Enclosures
6. Section 27 11 19 - Communications Termination Blocks and Patch Panels
7. Section 27 13 00 - Communications Backbone Cabling
8. Section 27 15 13 - Communications Copper Horizontal Cabling
9. Section 27 15 43 - Communications Faceplates and Connectors
10. Section 27 15 53 - Communications Cable Plant Testing
11. Section 27 41 00 – Audio Visual Systems

D. COS Information Technology Team: The COS Information Technology Team assigned a project manager for all aspects of this project and that project manager shall be referenced here-in-after as the COS Information Technology Project Coordinator (ITPC). At all phases of this project, address all requests for information (RFI), all correspondence, and all required submittals to the assigned ITPC. If there is a change in the assignment of the ITPC or the ITPC determines a temporary designate, those changes will be given to the contractor in writing.

E. Progress Review Meetings: During the execution phase of this project the selected Contractor shall be prepared to attend weekly progress review meetings with the assigned ITPC or his/her designate.

1.02 QUALITY CONTROL

A. The Contractor shall have a current State of California C-7 license.

B. All work shall be performed in a neat and workmanlike manner (also see Division 01).

C. Product, materials, and equipment provided by the Contractor shall be of the quality specified.

D. All materials furnished under this contract shall be new and of a regularly manufactured line, currently in production at the time of installation.

E. Codes: (Most recent editions with addenda/TSB, etc.) All materials, installation, and workmanship shall comply with the applicable requirements and codes addressed within the following references:

1. National Electrical Manufacturers Association (NEMA).
2. California Electrical Code (CEC).
3. ANSI/IEEE C2, National Electrical Safety Code (NESC).
4. FCC Rules and Regulations.
5. Local, county, state, and federal regulations and codes in effect as of the bid submission date.

F. Standards: (Most recent editions with addenda/TSB, etc.) All materials, installation, and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ANSI/TIA-568.1-D, Commercial Building Telecommunications Infrastructure Standard
2. ANSI/TIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard
3. ANSI/TIA-568.3-D, Optical Fiber Cabling and Components Standard
4. ANSI/TIA-568-C.4, Broadband Coaxial Cabling and Components Standard
5. ANSI/TIA-569-D, Telecommunications Pathways and Spaces
6. ANSI/TIA-570-C, Residential Telecommunications Infrastructure Standard
7. ANSI/TIA-606-B, Administration Standard for Telecommunications Infrastructure
8. ANSI/TIA-607-C, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
9. ANSI/TIA-758-B, Customer Owned Outside Plant Telecommunications Infrastructure Standard
10. ANSI/TIA-4966, Telecommunications Infrastructure Standard for Educational Facilities
11. BICSI - Telecommunications Distribution Methods Manual (TDMM)
12. BICSI - Outside Plant Design Reference Manual (OSPDRM)

13. BICSI - Wireless Design Reference Manual (WDRM)

14. All products shall be Underwriters Laboratories (UL) listed, or other nationally recognized testing laboratory acceptable to COS listed for the application intended.

G. Where conflicts exist from one code or standard to another, the code or standard to adhere to will be decided by the ITPC or his/her designate.

1.03 WARRANTIES

A. The Contractor shall provide a one (1) year material and labor warranty on all the work the Contractor has performed.

B. The Contractor shall provide the SCS system manufacturer's 25-year materials and link performance certification warranty for all new cable installed by the Contractor in his execution of the work of this specification.

1.04 MATERIAL SUBSTITUTIONS

A. All requests for substitutions of products shall be made and approved or disallowed during the stated bid period for this project - see Division 01.

B. Three (3) hard copies and a URL reference of all proposed product substitution documentation are required. Proposed product substitution documentation shall contain, at a minimum, the following:

1. The product manufacturer's performance specifications cut sheet(s).

2. If existing, the manufacturer's installation instructions and/or installation recommendations for that product.

C. Acceptance of proposed substitutions is at the discretion of the ITPC. Allow 10 working days for review and final decision.

D. Substitutions must comply with the warranty requirements specified above.

1.05 SUBMITTALS

A. Required submittals upon award of contract.

1. A complete network drop numbering plan set in COS drop numbering format in printed and electronic format (Autocad is preferred).

2. Mock-ups of each type of network drop faceplate to be furnished for this project. Each drop mock-up shall contain the following:

    a. Full load of required connectors with eighteen inches (18") of connector type appropriate specified cable terminated on each connector.

    b. Required drop faceplate labeling to include faceplate icons as required by these Division 27 Specifications and the accompanying construction drawing set.

3. Manufacturers' cut sheets for all products to be supplied by the Contractor in response to these Division 27 specification sections.

4. Listed fire stop system documentation - reference Section 27 05 41 - Fire Stopping for Communication Systems.

5. A copy of the Contractor's C-7 license.

6. A copy of testing personnel certification(s) that show they are properly trained in the use of the testing equipment that will be employed by the contractor - reference Section 27 15 53 - Cable Plant Testing.

7. Testing device(s) calibration documentation.

8. Copies of Contractor's Structured Cabling System (SCS) manufacturer's authorized vendor/installer Certification document(s).

B. Required submittals prior to final acceptance.

1. Two (2) sets of CDs or DVDs of the as-built drawings (AutoCAD or AutoCAD Lite Rev 2014 or later) - reference Section 27 15 53 - Cable Plant Testing.

2. Two (2) sets of CDs or DVDs of cable plant testing documentation - reference Section 27 15 53 - Cable Plant Testing.

3. Two (2) sets of CDs or DVDs of all fire stop pictures reference Section 27 05 41 - Fire Stopping for Communication Systems.

4. Two (2) copies of required warranties.

PART 2 - PRODUCTS

2.01 SECTION 27 06 00 - SCHEDULES FOR COMMUNICATIONS

A. It is recommended that the reader examine Section 27 06 00 - Schedules for Communications before continuing.

B. Section 27 06 00, Schedules for Communications presents the COS's pre-approved Product/Material Listing by Division 27 Section number. In this specification set product/material shall be specified by reference to the Product/Materials Schedule contained in Section 27 06 00.

C. The Contractor shall supply a complete and functioning system; if a product/material required for this project is not listed in Section 27 06 00 - Schedules for Communications, Products and Materials Schedule, it shall be furnished by Contractor with submittal approval by the ITPC or his/her designate.

D. The Product and Materials Schedule allows for "or equal" substitutions. When "or equal" product/material is substituted, the "or equal" product/material submitted shall be equivalent in every way to the product/material listed in Section 27 06 00 - Schedules for Communications, the Products and Materials Schedule - see Material Substitutions above. All products that the Contractor would like to submit as an “or equal” product must be submitted and approved by the ITPC or his/her designate.

2.02 QUANTITIES

Determining quantity of any given required item or product shall be the Contractor's responsibility using this specification and accompanying drawing set.

2.03 DEFINITION

In this Division 27 specification, the term "Furnish" shall mean "provide and install."

PART 3 - EXECUTION

3.01 COORDINATION

A. The Contractor shall coordinate the work specified in this Division 27 specification with the work of the other trades involved in this project.

B. The Contractor shall coordinate with Division 26 - Electrical concerning provision and installation of the following:

1. Conduit and cable tray pathway for communications.

2. Wall penetrations and floor coring for communications.

3. Backboxes for communications.

4. Telecommunications Space Power placement of communications.

5. Grounding and bonding for communications.

C. All questions and issues regarding coordination and construction element phasing shall be directed to the ITPC or his/her designate.

D. The Contractor shall coordinate their work so there shall be no disruption to any occupants of the COS campus unless coordinated and approved by the ITPC or his/her designate. Any necessary disruption shall be scheduled a minimum of 4 weeks in advance of its occurrence and affected parties shall be notified in writing of date, time, and planned duration of the disruption.

E. The Contractor shall follow all rules, regulations, and instructions stipulated by this specification, general provisions of the Contract, including General and Supplementary Conditions, and Division 01 specification sections, if issued in conjunction with these Division 27 specifications regarding the following:

1. Delivery hours.

2. Delivery locations.

3. Storage.

4. Hazardous Material.

5. Security.

6. Hours of work.

7. Safety.

8. Logistics.

3.02 INTENT OF DRAWINGS AND SPECIFICATIONS

A. Contractor shall keep on the Project site a copy of the Specifications and Drawings, and the same shall be available at all reasonable times for inspection and use by the ITPC or his/her designate and by any other person authorized by the ITPC or his/her designate. Any Drawings listed in the detail Specifications shall be regarded as a part thereof and of the Contract. Anything mentioned in these Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in these Specifications, shall be of like effect as though shown or mentioned in both.

B. It shall be the duty of Contractor to see that the provisions of these Specifications are complied with in detail irrespective of the inspection given the work during its progress by the ITPC or his/her designate. Any failure on the part of Contractor to observe the Specifications will be sufficient cause for the rejection of the work at any time before its acceptance.

C. The ITPC or his/her designate will furnish from time to time, such detail drawings, drawings, profiles, and information as the ITPC or his/her designate may consider necessary for Contractor's guidance to insure the proper and adequate execution of the Contract. Contractor shall comply with such detail drawings, drawings, profiles and information.

D. DO NOT USE drawing scale to determine exact dimensions or exact location. Scaled drawings are still to be considered diagrammatic and scale should be used for estimates only. If exact lengths or location placement dimensions are required, the drawings will specifically show those dimensions or placement coordinates.

3.03 INSTALLATION

Furnish all required materials, equipment, and tools necessary to properly complete the work of these specifications including, but not limited to, tools for pulling and terminating the cables, mounting hardware, ladders, lift equipment, cable ties, bolts, anchors, clamps, hangers, kits of consumables, lubricants, technician communication devices, cable testing equipment, stands for cable reels, cable wenches, etc.

3.04 EXAMINATION

A. The Contractor is responsible for examining existing conditions and comparing them with drawings and specifications and notifying the ITPC or his/her designate of any discrepancies.

B. The Contractor is responsible for coordinating with the ITPC or his/her designate to address, adjust, and resolve any discrepancies found before commencing work.

C. If a discrepancy between existing conditions and these drawings and specifications is found after commencing work, stop any work that in the Contractor's opinion is affected by the found discrepancy. It shall then be the Contractor's responsibility to resolve all issues caused by the found discrepancy before commencing work in work areas affected by the discrepancy.

3.05 VERIFICATION

A. It is incumbent upon the Contractor to verify that the installation and materials used have been inspected before they are enclosed within building features, or otherwise hidden from view. The Contractor shall bear costs associated with uncovering or exposing installations or features that have not been inspected and approved.

B. After installation, test, certify, and provide required warranties for the Structured Cabling System installed per the requirements of this specification.

3.06 ADJUSTMENTS

The Contractor is responsible for coordinating and documenting with the ITPC or his/her designate the change order process. Coordinate specific needed forms and procedures for change orders with the ITPC or his/her designate.

3.07 LABELING

The Contractor is responsible for labeling and documenting all aspects of the installed infrastructure. The Contractor will not receive acceptance or final payments until the ITPC agrees that labeling and documentation is completed for the project.

COS has multiple college campuses and many individual buildings throughout the District. A labeling standard is required to develop a consistent database of infrastructure and networking documents. Since there are “Administration Buildings”, “Agriculture”, and “Campus Center” buildings on multiple campuses, it is important to develop unique labeling scheme that identifies individual buildings, TRs, and cable drops identified for each unique college and campus. Please refer to the ITPC to confirm codes and alphas for the particular college, campus, and buildings that you are working with. The following labeling standard has been developed and the Contractor will follow the labeling standard in all aspects of the work.

A. Labeling elements:

Labeling Element	Digits	Symbol
College Designator	1	C
Site Name (Campus or standalone building site name)	1	X
Building (3 digit alpha code for the building)	3	BBB
MDF or IDF (1st digit = floor, 2nd digit = a,b,c,etc)	2	##
Patch panel (1st digit = P, 2nd digit = patch panel #)	2	P@
PP jack (the jack number 01-48 on the patch panel)	2	$$

B. Labeling examples:

Using two existing buildings on the Bakersfield College campus as an example, we will demonstrate how the labeling elements would be used to uniquely identify and label infrastructure. The Bakersfield College designator is “B”. Site name for the Bakersfield College main campus is “C”. The alpha designation for the Administration building is “ADN”. The alpha designation for the Campus Center is “CCR”.

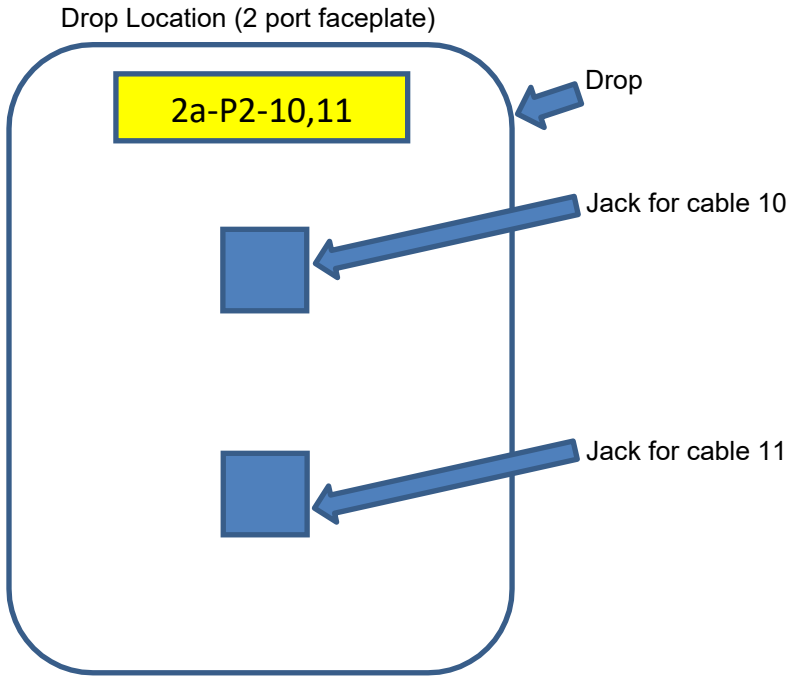
C. The label affixed to both ends of an outside plant fiber optic cable that feeds from the Administration building (TR 1a) to the Campus Center (TR 1a) would look like the following: BC-ADN-1a-BC-CCR-1a. Then the contractor would affix details of the cable such as copper count, fiber count, cable type, etc.

D. The label affixed to both ends of a riser cable that feeds from the Campus Center (TR 1a) to the Campus Center (TR 2a) would look like the following: BC-CCR-1a-BC-CCR-2a. Then the contractor would affix details of the cable such as copper count, fiber count, cable type, etc.

E. The label affixed to both ends of an individual data cable on a COS campus would look like the following: CX-BBB-##-P@-$$. This would clearly identify this cable to a unique college, building, TR, patch panel, and jack. An example using the Campus Center building second floor TR might be: BC-CCR-2a-P2-10, so this would be a cable connected to patch panel #2, jack 10, in TR 2a of the Campus Center building on college B (Bakersfield College), site name C (Main campus).

F. Each patch panel in the TR would be labeled with a patch panel number only (P1, P2, P3, etc). The manufacture jack labeling, numbers 01-48, would be used to indicate the jack number of the cables connected to the patch panel.

G. An as-built floor plan of the coverage area of the TR will be mounted inside each TR by the Contractor. The floor plan will show the rooms and drop locations fed by the TR. The physical drop faceplate and the drop location on the as-built floor plan will be labeled with the TR identification, patch panel, and jack number for each cable fed by the TR. An example of a typical 2 port drop location with two cables connected to ports 10 and 11 on patch panel 2 in TR 2a is shown below:



3.08 LIST OF REQUIRED AS-BUILT DRAWINGS

A. As stated under "Submittals" above, as-built drawing files shall be "AutoCAD" or "AutoCAD Lite" 2014 or later release.

B. The list of required as-built drawings is as follows:

1. All cabling drop faceplate locations with identification for each jack at that drop.

2. Two-inch (2”) and larger conduit pathways to include conduit size label.

3. Pull box locations.

4. Two-inch (2”) and four-inch (4”) J hook runs indicated by a line series of “x”s.

5. MDF/IDF layout labeled per current construction drawing field mark-ups.

6. Rack elevation labeled per current construction drawing field mark-ups.

7. Backbone copper and fiber schematic drawings with labeling information.

8. Updated outside plant drawings showing pathway, manholes, and pullboxes.

C After review of as-built drawings by the ITPC or his/her designate be prepared to make any required corrections for final submittal.

3.09 ACCEPTANCE

The project specified by this specification shall be considered completed and signed off as completed by the ITPC contingent upon the following:

1. All punch lists have been completed and signed as complete by the ITPC or his/her designate.

2. Required cable plant testing has been executed and required test result documentation has been submitted and approved by the ITPC or his/her designate - Refer to Section 27 15 53 - Communications Cable Plant Testing.

3. Any required adjustments to as-built drawings have been completed, submitted, and approved as complete by the ITPC or his/her designate.

4. Required warranty documentation has been submitted and approved as complete by the ITPC or his/her designate.

END OF SECTION

SECTION 270526
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communication bonding required by these specifications and related construction drawings.

B. Division 26 - Electrical specifications and accompanying drawings are particularly applicable to this section of this Division 27 specification.

C. The specification sections of this Division 27 that are particularly applicable to this section include, but are not limited to, the following:

1. Section 27 00 00 - Communications
2. Section 27 06 00 - Communications Schedules
3. Section 27 11 00 - Communications Equipment Room Fittings
4. Section 27 11 13 - Communications Entrance Protection
5. Section 27 11 16 - Communications Cabinets, Racks, Frames, and Enclosures
6. Section 27 11 19 - Communications Termination Blocks and Patch Panels.
7. Section 27 13 00 - Communications Backbone Cabling

1.02 QUALITY CONTROL

Comply with Section 27 00 00 - Communications.

1.03 WARRANTIES

Comply with Section 27 00 00 - Communications.

1.04 MATERIAL SUBSTITUTIONS

Comply with Section 27 00 00 - Communications.

1.05 SUBMITTALS

Comply with Section 27 00 00 - Communications.

1.06 COORDINATION

Comply with Section 27 00 00 - Communications.

PART 2 - PRODUCTS

2.01 QUANTITY DETERMINATION

Comply with Section 27 00 00 - Communications.

2.02 BUSBARS

Furnish all required telecommunications grounding system busbars - see Section 27 06 00 - Schedules for Communications, KCCD Master Pre-Approved Product/Material/Manufacturer List

Index, Product/Material Category, "Bonding."

2.03 BONDING CONDUCTORS

Furnish all required 6 AWG green thermoplastic insulated stranded copper wire - see Section 27 06 00 - Schedules for Communications, KCCD Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Bonding."

2.04 BONDING CONDUCTOR TERMINATIONS

A. Furnish all required two-hole compression lugs: Color coded to appropriate cable, high conductivity wrought copper, electro tin plated - see Section 27 06 00 - Schedules for Communications, KCCD Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Bonding."

B. All bonding compression lugs and other bonding hardware shall be Underwriters Laboratories (UL), or other nationally recognized testing laboratory acceptable to ###, listed for the application intended.

PART 3 - EXECUTION

3.01 GENERAL

The contractor shall comply with all requirements as listed in ANSI/TIA/EIA-STD-607-A “Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications” whether shown on the drawings or not.

3.02 INSTALLATION

A. Install busbars per manufactures instructions and at locations shown on the accompanying drawings. If locations are unclear, clarify location with ITPC before installing.

B. Provide all bonding as specified by these Division 27 specifications and the conjoined construction drawings. In particular make sure, when present in a Telecommunication Room (TR), that the following elements are bonded:

1. Metallic equipment racks.

2. Cable shields.

3. All metal raceways and cable trays.

C. Bonding conductors shall be continuous and routed in as direct a route as possible to the point of termination while adhering to the following: No bonding conductor shall vertically traverse a wall except at wall corners.

D. Clean ground bars prior to terminating bonding conductors.

3.03 EXAMINATION

Comply with Section 27.00 00 – Communications.

3.04 LABELING

A. Reference construction drawings accompanying this Division 27 specification.

B. Comply with Section 27.00 00 – Communications.

C. Label all telecommunications bonding conductors as close as possible to the termination

points with an ANSI/TIA/EIA 606 compliant label for bonding.

3.05 AS-BUILT DRAWINGS

Comply with Section 27 15 53 - Communications Cable Plant Testing.

Comply with Section 27 00 00 – Communications.

END OF SECTION

Section 270600
SCHEDULE FOR COMMUNICATIONS

Important Notes

1. SUBMITTALS REQUIRED - See specifications, Section 27 00 00, PART 1 - GENERAL, SUBMITTALS.
2. Any submittal of an "or equal" product must contain the product manufacturer's performance specifications cut sheet for that product.
3. Items not showing manufacturer and part # shall be furnished by the Contractor with submittal approval by the KCCD Information Technology Team.
4. Not all items listed are necessarily required for this project
5. If Line #s appear not to be sequential, those items have been removed since they are not required for this project.

Line #	Division 27 Section Number	Division 27 Section Name	Approved Manufacturer	Part #	As Specified, Or Equal	Description
1	27 05 26	Grounding and Bonding for Communications Systems	Cooper B-Line	SB47902	Or Equal	Two-hole compression lugs
2	27 05 26	Grounding and Bonding for Communications Systems			Or Equal	6 AWG, green insulation, bonding wire
3	27 05 26	Grounding and Bonding for Communications Systems	Panduit	LTYK	Or Equal	J-STD-607-A Compliant Bonding Tag
4	27 05 26	Grounding and Bonding for Communications Systems	Cooper B-Line	SB6693/4X101/2	Or Equal	Grounding Strap
5	27 05 26	Grounding and Bonding for Communications Systems	Chatsworth Products	10610-019	Or Equal	Horizontal Rack Grounding Busbar
6						
7	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	11275-712	Or Equal	12" Cable Runway
8	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	11301-001	Or Equal	Butt Splice
9	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	11312-718	Or Equal	Triangular Runway Wall Support Kit
10	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	11302-701	Or Equal	Runway 90 degree junction Splice Clamp and Kit
11	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	11421-712	Or Equal	Runway Wall Angle Support Kit
12	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	0506-716	Or Equal	Runway Elevation Kit for Cabinets
13	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	10506-706	Or Equal	Runway Elevation Kit for Racks
14	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	12730-712	Or Equal	Runway Rack Mounting Plate
15	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	40164-001	Or Equal	Cable Runway Grounding Strap Kit
16	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	11309-701	Or Equal	Foot Kit Cable Runway
17	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	10608-701	Or Equal	Vertical Wall Brackets
18	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	10873-001	Or Equal	Slip-On Support Bracket
19	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	30139-719	Or Equal	1RU Horizontal Wire Manager – Front Only – With Cover
20	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	30130-719	Or Equal	2RU Horizontal Wire Manager – Front Only – With Cover
21	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	40098-703	Or Equal	7' Vertical Cable Manager – 6”
22	27 11 00	Communications Equipment Room Fittings	Chatsworth Products	40099-703	Or Equal	7' Vertical Cable Manager – 10”
23						
24	27 11 13	Communications Entrance Protection	Circa	1880ECA1-25	Or Equal	Twenty-Five (25) pair BET technology
25	27 11 13	Communications Entrance Protection	Circa	4B3S-75	Or Equal	3 pin, solid-state technology protectors
26						
27						

Important Notes

1. SUBMITTALS REQUIRED - See specifications, Section 27 00 00, PART 1 - GENERAL, SUBMITTALS.
2. Any submittal of an "or equal" product must contain the product manufacturer's performance specifications cut sheet for that product.
3. Items not showing manufacturer and part # shall be furnished by the Contractor with submittal approval by the KCCD Information Technology Team.
4. Not all items listed are necessarily required for this project
5. If Line #s appear not to be sequential, those items have been removed since they are not required for this project.

Line #	Division 27 Section Number	Division 27 Section Name	Approved Manufacturer	Part #	As Specified, Or Equal	Description
28	27 11 16	Communications Cabinets, Racks, Frames and Enclosures	Chatsworth Products	M1043-741	Or Equal	Floor Mount Cabinet - 19" x 45 RMU x 39" D
29	27 11 16	Communications Cabinets, Racks, Frames and Enclosures	Chatsworth Products	46353-705	Or Equal	2-Post Rack
30						
31	27 11 19	Communications Termination Blocks and Patch Panels	Siemon	HD6-48	Or Equal	CAT 6 48 port modular patch panels
32	27 11 19	Communications Termination Blocks and Patch Panels	Siemon	HD6-24	Or Equal	CAT 6 24 port modular patch panels
33	27 11 19	Communications Termination Blocks and Patch Panels	Siemon	RIC3-48-01	Or Equal	3 RU Fiber optic patch panel
34	27 11 19	Communications Termination Blocks and Patch Panels	Siemon	FCP3-DWR	Or Equal	1 RU Fiber optic patch panel
35	27 11 19	Communications Termination Blocks and Patch Panels	Siemon	RIC-F-LCE24-01C	Or Equal	Fiber adapter plate, 24 Fiber, LC, Erika Violet Adapter
36						
37	27 13 00	Communications Backbone Cabling	General Cable	7525758	Or Equal	OSP Backbone Copper Cable – 25 Pair
38	27 13 00	Communications Backbone Cabling	Berk-Tek	OPDD12B024FB3010/F5	Or Equal	OSP Backbone Fiber Optic Cable – 24 Strand – OM4 – Loose Tube
39	27 13 00	Communications Backbone Cabling	Berk-Tek	10033625	Or Equal	Field Breakout Kit – 12 buffer tubes, 36”
40						
41	27 15 13	Communications Copper Horizontal Cabling	Berk-Tek	LANmark-1000	Or Equal	Category 6, Plenum Rated, Blue Jacket
42	27 15 13	Communications Copper Horizontal Cabling	Berk-Tek	LANmark-XTP	Or Equal	Category 6A, Plenum Rated, Blue Jacket
43						
44	27 15 43	Communications Faceplates and Connectors	Siemon	MX-FP-S-02-02	Or Equal	Data faceplate – 2 Port
45	27 15 43	Communications Faceplates and Connectors	Siemon	MX-FP-S-04-02	Or Equal	Data faceplate – 4 Port
46	27 15 43	Communications Faceplates and Connectors	Siemon	MX-FP-S-06-02	Or Equal	Data faceplate – 6 Port
47	27 15 43	Communications Faceplates and Connectors	Siemon	MX-SM2-02	Or Equal	Surface Mount Box – 2 Port
48	27 15 43	Communications Faceplates and Connectors	Siemon	MX6-06	Or Equal	Data Termination – Category 6, Blue
49	27 15 43	Communications Faceplates and Connectors	Siemon	Z6A-06	Or Equal	Data Termination – Category 6A, Blue
50	27 15 43	Communications Faceplates and Connectors	Siemon	MC6-05-06	Or Equal	Work Area Patch Cords – Category 6, 16.4’
51	27 15 43	Communications Faceplates and Connectors	Siemon	MC6-XX-02	Or Equal	Patch Cords – 40% 3.3’, 40% 6.6, 20% 9.8’
52	27 15 43	Communications Faceplates and Connectors	Siemon	ZM6A-03-06	Or Equal	WAP Patch Cord – Category 6A, 3’
53						

Important Notes

1. SUBMITTALS REQUIRED - See specifications, Section 27 00 00, PART 1 - GENERAL, SUBMITTALS.
2. Any submittal of an "or equal" product must contain the product manufacturer's performance specifications cut sheet for that product.
3. Items not showing manufacturer and part # shall be furnished by the Contractor with submittal approval by the KCCD Information Technology Team.
4. Not all items listed are necessarily required for this project
5. If Line #s appear not to be sequential, those items have been removed since they are not required for this project.

Line #	Division 27 Section Number	Division 27 Section Name	Approved Manufacturer	Part #	As Specified, Or Equal	Description
54						
55						
56						
57						
58						
59						
60						

SECTION 271100
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of equipment room fittings as called for in these specifications and accompanying drawings.

B. Those specification Sections of this Division 27 that are particularly applicable to this Section include, but are not limited to, the following:

1. Section 27 00 00 - Communications
2. Section 27 06 00 - Communications Schedules
3. Section 27 05 26 - Grounding and Bonding for Communications Systems
4. Section 27 11 13 - Communications Entrance Protection
5. Section 27 11 16 - Communications Cabinets, Racks, Frames, and Enclosures
6. Section 27 11 19 - Communications Termination Blocks and Patch Panels.
7. Section 27 15 13 - Communications Copper Horizontal Cabling

C. Division 16 - Electrical also has sections that maybe applicable to this section of the Division 27 - Communications specification set.

D. Division 28 - Electronic Safety and Security also has sections that maybe applicable to this section of the Division 27 - Communications specification set.

1.02 QUALITY CONTROL

Comply with Section 27 00 00 - Communications.

1.03 WARRANTIES

Comply with Section 27 00 00 - Communications.

1.04 MATERIAL SUBSTITUTIONS

Comply with Section 27 00 00 - Communications.

1.05 SUBMITTALS

Comply with Section 27 00 00 - Communications.

1.06 COORDINATION

Comply with Section 27 00 00 - Communications.

PART 2 - PRODUCTS

2.01 QUANTITY DETERMINATION

Comply with Section 27 00 00 - Communications.

2.02 CABLE TRAY

A. Furnish all required cable tray - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, “Telecom Room."

B. Furnish all required of the following:

1. Butt Splices;
2. Triangle Wall Brackets;
3. Junction Splices;
4. Wall Angle Support Kits;
5. Cable Tray Elevation Kits;
6. Single Earthquake Brackets;
7. Waterfall upper trays;
8. Horizontal Cable Managers;
9. Upper Tray Cable Managers;
10. ANSI/TIA/EIA STD-607-A Compliant Bonding Tags.

C. See Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Telecom Room."

2.03 EQUIPMENT RACK VERTICAL CABLE MANAGERS

Furnish all required vertical cable managers; see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Telecom Room."

2.04 EQUIPMENT RACK HORIZONTAL CABLE MANAGERS

Furnish all required horizontal cable managers; see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Telecom Room."

2.05 CABLE TRAY & CABLE MANAGER PIECE PARTS AND ACCESSORIES

Furnish all other piece parts and accessories to complete the accompanying construction drawing set communications room layouts. Use only manufacturer-supplied and/or manufacturer-provided hardware.

PART 3 - EXECUTION

3.01 GENERAL

The Contractor shall make field adjustments and resolve conflicts between accompanying construction drawings, specifications, and field conditions before beginning cable tray and/or vertical cable manager installation.

3.02 INSTALLATION

A. Cable tray shall be supported at intervals of no greater than every four (4) feet.

B. Follow cable tray, vertical cable manager, and horizontal cable manager elevations and layout patterns that are specified in the accompanying construction drawings as closely as field conditions will permit. Any proposed deviations, including those caused by field conditions, must be approved by the ITPC or his/her designate.

3.03 EXAMINATION

Comply with Section 27.00 00 – Communications.

3.04 ADJUSTMENTS

Comply with Section 27.00 00 – Communications.

3.05 AS BUILT DRAWINGS

Comply with Section 27 15 53 - Communications Cable Plant Testing.

3.06 ACCEPTANCE

Comply with Section 27.00 00 – Communications.

END OF SECTION

SECTION 271113
ENTRANCE PROTECTION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of outside plant cable (OSP) Building Entrance Terminal (BET) protection and termination for copper cabling as called for in these specifications and related drawings.

B. Coordinate location of entrance protection with COS Information Technology Project Coordinator (ITPC).

C. Division 26 - Electrical specifications and accompanying drawings are particularly applicable to this section of this Division 27 specification.

D. The specification sections of this Division 27 that are particularly applicable to this section include, but are not limited to, the following:

1. Section 27 00 00 - Communications
2. Section 27 06 00 - Communications Schedules
3. Section 27 11 00 - Communications Equipment Room Fittings
4. Section 27 11 16 - Communications Cabinets, Racks, Frames, and Enclosures
5. Section 27 11 19 - Communications Termination Blocks and Patch Panels.
6. Section 27 13 00 - Communications Backbone Cabling

1.02 QUALITY CONTROL

Comply with Section 27 00 00 - Communications.

1.03 WARRANTIES

Comply with Section 27 00 00 - Communications.

1.04 MATERIAL SUBSTITUTIONS

Comply with Section 27 00 00 - Communications.

1.05 SUBMITTALS

Comply with Section 27 00 00 - Communications.

1.06 COORDINATION

Comply with Section 27 00 00 - Communications.

PART 2 - PRODUCTS

2.01 QUANTITY DETERMINATION

Comply with Section 27 00 00 - Communications.

2.02 MANUFACTURES

There is no preferred manufacturer.

2.03 MATERIALS AND FABRICATION

A. BET technology to include fusible link.

B. Protector technology: 5-Pin, 300V, 350 mA.

C. Miscellaneous parts and material required to complete a successful installation of the BET technology, such as splice case and associated hardware

PART 3 - EXECUTION

3.01 GENERAL

Comply with Section 27 00 00 - Communications.

3.02 INSTALLATION

A. Copper outside plant cabling

1. Install a Building Entrance Terminal protector unit for every 100 pairs of OSP entrance cable or entrance tie cable as specified in the drawings.

2. Mount the protector units in columns of not more than three units, with the top surface of the upper-most unit 6 feet A.F.F. Use mounting hardware recommended by the manufacturer.

3. Bond all protectors in each BET together using 1/0 AWG (6 AWG allowed) ground wire, in daisy chain style. Connect a segment of ground wire from the top unit to the Telecommunication Grounding Buss Bar in the telecommunications room. Install 100 5-pin protector units for each protector terminal.

4. Splice entrance cable or entrance tie cable to 26 AWG protector terminal fuse cable pigtails. Secure the splice case vertically on the TR wall as shown on the contract drawings.

5. The Contractor shall bond the shield of each OSP cable to the Telecommunication Grounding Buss Bar (TGBB) provided at the entrance facilities using 1/0 AWG copper wire.

6. At the termination end of multi-pair OSP cables, the Contractor shall provide six feet of managed service slack.

7. Label Building Entrance Terminals according standards listed in section 27 00 00.

B. Test all terminated pairs of each copper backbone cable segment from the BET output field through the installed protector for the following:

1. Continuity to remote end.

2. Shorts between any two or more conductors.

3. Transposed pairs.

4. Reversed pairs.

5. Split pairs.

6. Grounded conductor.

7. Shield continuity.

3.03 EXAMINATION

Comply with Section 27 00 00 – Communications.

3.04 LABELING

A. Reference construction drawings accompanying this Division 27 specification.

B. Label all OSP and telecommunications bonding conductors as close as possible to the termination points with an ANSI/TIA/EIA 606 compliant label for bonding.

C. Comply with Section 27 00 00 – Communications.

3.05 AS-BUILT DRAWINGS

Comply with Section 27 15 53 - Communications Cable Plant Testing.

Comply with Section 27 00 00 – Communications.

END OF SECTION

SECTION 271116
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communication cabinets, racks, frames and enclosures as called for in this Section of the Division 27 specifications and accompanying construction drawings.

B. Those specification Sections of this Division 27 that are particularly applicable to this Section include, but are not limited to, the following:

1. Section 27 00 00 - Communications

2. Section 27 05 26 - Grounding and Bonding for Communications Systems

3. Section 27 06 00 - Communications Schedules

4. Section 27 11 00 - Communications Equipment Room Fittings

5. Section 27 11 13 - Communications Entrance Protection

6. Section 27 11 19 - Communications Termination Blocks and Patch Panels.

7. Section 27 15 13 - Communications Copper Horizontal Cabling

8. Section 27 15 53 - Cable Plant Testing

C. Division 16 - Electrical also has sections that maybe applicable to this section of the Division 27 - Communications specification set.

D. Division 28 - Electronic Safety and Security also has sections that maybe applicable to this section of the Division 27 - Communications specification set.

1.02 QUALITY CONTROL

Comply with Section 27 00 00 - Communications.

1.03 WARRANTIES

Comply with Section 27 00 00 - Communications.

1.04 MATERIAL SUBSTITUTIONS

Comply with Section 27 00 00 - Communications.

1.05 SUBMITTALS

Comply with Section 27 00 00 - Communications.

1.06 COORDINATION

Comply with Section 27 00 00 - Communications.

PART 2 - PRODUCTS

2.01 QUANTITY DETERMINATION

Comply with Section 27 00 00 - Communications.

2.02 CABINETS

A. Furnish and install all cabinets - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Telecom Room."

B. Furnish all parts and hardware to construct and outfit the cabinets as shown on the construction drawing set accompanying this specification.

2.03 RACKS

A. Furnish and install all 2-post equipment racks - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Telecom Room."

B. Furnish all parts and hardware to construct and outfit the equipment racks as shown on the construction drawing set accompanying this specification.

2.04 WIFI BOLLARDS

A. Furnish and install all WIFI Bollards

B. WIFI Bollards shall be 11-inches in diameter x 48-inches in height with an angled top.

C. WIFI Bollards shall be constructed of polyethylene thermoplastic cylinder with a sloped top that is virtually transparent to wireless signals. Provide a fiberglass equipment mounting pole with pole base with flange, anchor base and concrete equipment base, U-bolts and both right angle and Cisco mounting plates, tamper-resistant screws, and all mounting hardware and accessories.

D. WIFI Bollards shall be the Oberon Model 3032-00-LTGY-48.

PART 3 - EXECUTION

3.01 GENERAL

A. Before anchoring cabinets, racks, or frames to floor, wall, or overhead runway/cable tray in any telecom room, review their in place layout with the ITPC, or his/her designate. When they give approval of in place layout, proceed with anchoring.

B. The Contractor shall comply with all SCS bonding requirements as listed in ANSI/TIA/EIA-STD-607-A “Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications” whether shown on the accompanying drawings or not.

3.02 INSTALLATION

A. Install all cabinets, racks, frames, and enclosures per manufacturers’ installation specification, instructions, and anchorage/supports as indicated in drawings.

B. Bond all cabinets, racks, frames, and enclosures to the Telecommunication Grounding Buss Bar (TGBB) using 6 AWG Green thermoplastic insulated stranded copper wire.

3.03 LABELING

A. Comply with Section 27 00 00 - Communications.

B. Before labeling any equipment rack or cabinet confer with the ITPC and his/her designate to determine label content and placement.

3.04 AS BUILT DRAWINGS

Comply with Section 27 15 53 - Communications Cable Plant Testing.

END OF SECTION

SECTION 271119
COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of communication blocks and patch panels as called for in this section of the Division 27 specifications and conjoined construction drawings.

B. The specification sections of this Division 27 that are particularly applicable to this section include, but are not limited the following:

1. Section 27 00 00 - Communications

2. Section 27 06 00 - Communications Schedules

3. Section 27 11 13 - Communications Entrance Protection

4. Section 27 13 00 - Communications Backbone Cabling

5. Section 27 15 13 - Communications Copper Horizontal Cabling

6. Section 27 15 53 - Cable Plant Testing

C. Division 28 - Electronic Safety and Security also has sections that maybe applicable to this section of the Division 27 - Communications specification set.

1.02 QUALITY CONTROL

Comply with Section 27 00 00 - Communications.

1.03 WARRANTIES

Comply with Section 27 00 00 - Communications.

1.04 MATERIAL SUBSTITUTIONS

Comply with Section 27 00 00 - Communications.

1.05 SUBMITTALS

Comply with Section 27 00 00 - Communications.

1.06 COORDINATION

Comply with Section 27 00 00 - Communications.

PART 2 - PRODUCTS

2.01 QUANTITY DETERMINATION

Comply with Section 27 00 00 - Communications.

2.02 COPPER TERMINATION BLOCKS

A. Furnish all 110 (or approved equal) termination block fields required to terminate the copper backbone (riser) cabling and the voice cross-connect system cabling - Reference Section 27 15 13 - Communications Horizontal Cabling.

B. Furnish all required 110 system (or approved equal) C4 and C5 termination blocks.

C. Furnish all required pair grouping 110 (or approved equal) termination block label strips.

D. See Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Telecom Room."

2.03 COPPER PATCH PANELS

A. Furnish all patch panels required to support the TR terminations of the horizontal cabling.

B. Furnish all patch panels required to support the voice cross-connect system - Reference Section 27 15 13 - Communications Horizontal Cabling.

C. See Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Telecom Rm."

2.04 BACKBONE FIBER PATCH PANELS

A. Furnish all required wall mount fiber patch panels - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product Material Category "Fiber."

B. Furnish all required rack mount fiber patch panels - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product Material Category, "Fiber."

C. Furnish all fiber patch panel piece parts required for the termination of SMF and MMF optical fiber backbone cables and complete build-out of associated fiber patch panels including blank fill plates - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product Material Category, "Fiber."

D. SMF fiber connectors: Furnish all required SMF connector "Pigtails" - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product Material Category, "Fiber."

E. MMF fiber connectors: Furnish all required MMF connector "Pigtails" - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product Material Category, "Fiber."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Copper backbone termination.

1. Mount 110 (or approved equal) termination fields per manufacturer's specifications, instructions, and recommendations. Use accompanying construction drawing set to determine mounting locations and configurations.

2. Backbone cables are to be routed neatly on overhead cable runway to block termination locations. For cable management from cable runway to block termination and the dressing of cable at the blocks, follow manufacturer’s specifications, instructions, and recommendations and standard industry practices.

3. Terminate all riser backbone cables per manufacturer’s specifications, instructions, and recommendations.

4. At the termination end of multi-pair riser cables, the Contractor shall provide 15 feet (15') of managed service slack.

5. If removal of the cable jacket is required to facilitate routing of ARMM or plenum backbone cable into the blocks, the exposed cable pairs shall be fully covered with black or gray plastic tape, neatly lapped to prevent gaps.

6. Install five (5) pair and four (4) pair 110 I.D. strips for backbone cabling as required per the construction drawing set accompanying this Division 27 specification.

B. Cable drop horizontal cable termination.

1. Install one (1) 48-port patch panel for every 48 horizontal UTP data cables.

2. Mount patch panels per the construction drawing set accompanying this Division 27 specification. Note: See Section 27 11 00 - Communications Equipment Room Fittings.

3. Horizontal cables are to be routed neatly on overhead cable runway to equipment racks; exit cable runway into equipment rack vertical cable management and proceed to the patch panels.

4. Cable termination.

a. Cables on the left side of the patch panel shall enter from the left side vertical cable manager. Cables on the right side of the patch panel shall enter from the right side vertical cable manager. Cables shall not cross the center line of the patch panel.

b. Terminate cables using the 8-pin jack, T568-B four (4) pair termination standard and comply with manufacturer's termination practices, specifications, instructions, and recommendations.

C. Voice cross-connect system termination.

1. 110 or approved equal cable end termination.

a. Mount 110 (or approved equal) termination fields per manufacturer's specifications, instructions, and recommendations. Use accompanying construction drawing set to determine mounting locations and configurations.

b. 110 or approved equal C4 blocks shall be used for all but the last position on each twenty-five (25) pair row of a 110 one hundred (100) pair field and C5 blocks for the last five (5) pair positions in each twenty-five (25) pair row.

2 Patch panel end terminations.

a. Install one (1) 24-port patch panel for voice cross-connect system to 110 block.

b. Mount patch panels per the construction drawing set accompanying this Division 27 specification. Note: See Section 27 11 00 - Communications Equipment Room Fittings. Each patch panel shall have a 2RU horizontal manager placed both above and below the panel.

c. Terminate multi-pair copper cables using termination standard and comply with manufacturer's termination practices, specifications, instructions, and recommendations at 110 block and 24-port patch panel.

D. Fiber backbone cable termination.

1. Install at the locations indicated on the construction drawing set and per manufacturer's specifications, instructions, and recommendations the wall mount and rack mount optical fiber patch panels.

2. Fiber backbone cables are to be routed neatly on overhead cable runway to patch panel termination locations. For cable management from cable runway to patch panel termination and the dressing of cable at the patch panel termination, follow manufacturer’s specifications, instructions, recommendations, and standard industry practices.

3. Before terminating fiber backbone cable neatly install twenty-five feet (25') of service loop slack on Telecommunication Room wall near location where backbone cable is to be terminated. Diameter of service loops shall be eighteen inches (18").

4. Terminate fiber backbone cable by fusion splicing the appropriate connector "Pigtail" to the backbone cable. Comply with manufactures specifications, instructions, and recommendations.

5. Fiber connector "Pigtail" splicing: Use only fusion splicing to splice fiber connector pigtails to fiber backbone cable. No other splicing methodology shall be allowed.

3.02 EXAMINATION

Comply with Section 27 00 00 – Communications.

3.03 ISP/OSP BACKBONE COPPER 110 TERMINATION BLOCK LABELING

A. Comply with Section 27 00 00 – Communications.

B. 110 block cable ID label shall be as follows:

1. Label shall be COS generated cable number - from Telecommunications Room (TR) number - cable pair count per 25 pairs (1-25, 26-50, etc.).

2. 'From' COS building Telecommunications Room (TR) number for ISP riser or 'From' COS building number for OSP cable.

3. Cable pair count per 25 pairs (1-25, 26-50, etc.)

C. See ITPC or his/her designate to obtain COS generated cable number.

D. Pair call-out labeling: Pair call-out labeling shall designate every fifth (5th) pair consecutively through total pair count of the cable terminated on the block but not including the first (1st) and twenty-fifth (25th) pairs of each twenty-five (25) pair field bundle: Example for fifty (50) pair cable -- 5, 10, 15, 20, 30, 35, 40, 45.

E. All labels shall be machine/printer created labels. Hand labeling is not acceptable unless approved in writing as acceptable by the ITPC or his/her designate.

3.04 HORIZONTAL COPPER PATCH PANEL LABELING

A. Comply with Section 27 00 00 – Communications.

B. Label placement.

1. Label each patch panel with a patch panel number. P1 for patch panel 1, P2 for patch panel 2, etc.

2. Modular jack assignment number and TR patch panel port number shall be the same number.

C. All labels shall be machine/printer created labels. Hand labeling is not acceptable unless approved in writing as acceptable by the ITPC or his/her designate.

3.05 BACKBONE FIBER PATCH PANEL LABELING

A. Comply with Section 27 00 00 – Communications.

B. Each backbone fiber patch panel shall have a header label.

C. Header Label format and content shall be as follows:

1. COS generated cable number. See ITPC or his/her designate to obtain COS generated cable number.

2. 'From' COS building Telecommunication Room (TR) number for ISP riser or 'From' COS building number- TR number for OSP cable.

3. Fiber strand type designation and strand count. SM (single mode) XX; MM (multi-mode) XX where XX = strand count. If cable is a hybrid make sure both strand type counts are accounted for in header label.

D. Fiber Patch Panel Port Labeling: Label each fiber patch panel port with the strand count terminated on the port.

E. All labels shall be printed labels. Hand labeling is not acceptable unless approved in writing as acceptable by the ITPC or his/her designate.

3.06 VOICE CROSS-CONNECT SYSTEM LABELING

A. The 110-Blocks shall be labeled “Voice Cross-Connect to Rack #_ Panel # ”. Each cable shall be numbered from 01-48 on the 110-block Designation Strips.

B. The patch panels on the racks shall be labeled “Voice Cross-Connect Rack #_ Panel # ”. Each modular jack shall be numbered from 01-48 on each panel.

3.07 TESTING

Comply with Section 27 15 53 - Communications Cable Plant Testing.

3.08 AS-BUILT DRAWINGS

Comply with Section 27 15 53 - Communications Cable Plant Testing.

3.09 ADJUSTMENTS

Comply with Section 27 00 00 – Communications.

3.10 ACCEPTANCE

Comply with Section 27 00 00 – Communications.

END OF SECTION

SECTION 271300
COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation and termination of new backbone cabling as specified in this section of the specifications.

B. The backbone portion of the cabling system specified in this section provides a connection between MDF/IDF rooms within this building and to remote buildings on campus.

C. All specifications and conjoined construction drawings issued as part of the construction documentation for this project are applicable to this Division 27 and this section. Those specifications that are particularly applicable to this section include, but are not limited to, the following:

1. Division 26 – Electrical

2. Section 27 00 00 - Communications

3. Section 27 06 00 - Schedules for Communications

4. Section 27 11 00 - Communications Equipment Room Fittings

5. Section 27 11 19 - Communications Termination Blocks and Patch Panels

6. Section 27 15 13 – Communications Copper Horizontal Cabling

7. Section 27 15 43 - Communications Faceplates and Connectors

8. Section 27 15 53 - Communications Cable Plant Testing

1.02 QUALITY CONTROL

Comply with Section 27 00 00 - Communications.

1.03 WARRANTIES

Comply with Section 27 00 00 - Communications.

1.04 MATERIAL SUBSTITUTIONS

Comply with Section 27 00 00 - Communications.

1.05 SUBMITTALS

Comply with Section 27 00 00 - Communications.

1.06 COORDINATION

Comply with Section 27 00 00 - Communications.

PART 2 - PRODUCT

2.01 QUANTITY DETERMINATION

Comply with Section 27 00 00 - Communications.

2.02 OPTICAL FIBER CABLE

Furnish all required cable and fanout kits - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Communications Backbone Cabling."

2.03 COPPER BACKBONE CABLING

Furnish all copper backbone cable required to support the voice services cross-connect system- see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Communications Backbone Cabling."

PART 3 – EXECUTION

3.01 GENERAL

A. All cable runs shall be installed per manufacturer's installation instructions.

B. Cable installation is “home-run” between each MDF/IDF.

1. Each cable shall be installed without any splices.

2. Each cable shall be installed without intermediate termination points unless approved by COS or his/her designate in writing.

3.02 BACKBONE CABLE PLACEMENT

A. No cable shall run unsupported by conduit, cable tray, hangers, or other specified support for distances greater than five feet (5’).

B. Inner ducts shall be installed with fiber through any new conduits.

C. No cable or cable bundle shall be supported by or attached by any means to fire sprinkler heads, delivery system hardware, environmental sensor system hardware, or the exterior of any conduit, ladder rack, or cable tray. Cable shall be supported by systems specifically installed for cable support.

D. Where cable being installed is not enclosed in conduit or cable tray, cross all electrical power circuit transport at right angles.

E. Where discontinuity of cable trays or conduit pathway occurs that causes cable or cable bundle to sag vertically three inches (3") or more, support the cable or cable bundle over the discontinuity using hangers, brackets, hooks, rings, and other applicable supporting devices specified.

F. During placement of cable runs, do not exceed manufacturer's maximum pulling tension or minimum bend radius limits.

G. Manage slack to avoid excess cable or kinking.

J Pull new pulling tape through all conduits while placing new cable. Leave a pulling tape in the utilized conduits for future use.

K. Do not roll or store cable reels without an appropriate underlay.

L. Maintain the following clearances from EMI sources:

1. Unshielded power lines or equipment less than or equal to 5 kVA near cable in open or non-metal pathway: twelve inches (12").

2. Unshielded power lines or equipment greater than 5 kVA near cable in open or non-metal pathway: twenty-four inches (24").

3. Unshielded power lines or equipment less than or equal to 5 kVA near cable in grounded metal pathway: six inches (6").

4. Unshielded power lines or equipment greater than 5 kVA near cable in grounded metal pathway: twelve inches (12").

5. Power lines enclosed in grounded metal conduit less than or equal to 5 kVA near cable in grounded metal pathway: three inches (3").

6. Power lines enclosed in grounded metal conduit greater than 5 kVA near cable in grounded metal pathway: six inches (6").

7. Fluorescent fixtures near cable in open or non-metal pathway: twelve inches (12").

8. Fluorescent fixtures near cable in grounded metal conduit: six inches (6").

9. Motors or transformers near cable in non-metal pathway: forty-eight inches (48").

10. Motors or transformers near cable in grounded metal pathway: thirty-six inches (36").

11. Radiating coaxial cabling: six inches (6”).

M. After cable installation is complete, tested, and, if necessary, repairs made, install all required fire stopping. The ITPC or his/her designate will not accept the installation as completed until all required fire stopping has been installed and accepted as complete.

3.03 TERMINATION

Comply with Section 27 11 19 - Communications Termination Blocks & Patch Panels and Section 27 15 43 - Communications Faceplates and Connectors.

3.04 EXAMINATION

Comply with Section 27 00 00 – Communications.

3.05 LABELING

A. Comply with Section 27 00 00 – Communications.

B. Label placement: Attach a label to both ends of each cable six inches (6") from the cables termination at the drop and TR patch panel port.

C. All labels shall be machine created labels. Hand labeling is not acceptable.

3.06 TESTING

Comply with Section 27 15 53 - Communications Cable Plant Testing.

3.07 AS-BUILT DRAWINGS

Comply with Section 27 00 00 – Communications.

3.10 VERIFICATION

Comply with Section 27 00 00 – Communications.

3.11 ADJUSTMENTS

Comply with Section 27 00 00 – Communications.

3.12 ACCEPTANCE

Comply with Section 27 00 00 – Communications.

END OF SECTION

SECTION 271513
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation and termination of new horizontal cabling as specified in this section of the specifications.

B. The horizontal link portion of the cabling system specified in this section extends from the modular jack termination of the cable at the drop faceplate to its patch panel modular jack termination in its assigned telecommunication room (TR). It also applies to the voice cross- connect system described below.

C. All specifications and conjoined construction drawings issued as part of the construction documentation for this project are applicable to this Division 27 and this section. Those specifications that are particularly applicable to this section include, but are not limited to, the following:

1. Division 26 – Electrical

2. Section 27 00 00 - Communications

3. Section 27 06 00 - Schedules for Communications

4. Section 27 11 00 - Communications Equipment Room Fittings

5. Section 27 11 19 - Communications Termination Blocks and Patch Panels

6. Section 27 15 43 - Communications Faceplates and Connectors

7. Section 27 15 53 - Communications Cable Plant Testing

1.02 QUALITY CONTROL

Comply with Section 27 00 00 - Communications.

1.03 WARRANTIES

Comply with Section 27 00 00 - Communications.

1.04 MATERIAL SUBSTITUTIONS

Comply with Section 27 00 00 - Communications.

1.05 SUBMITTALS

Comply with Section 27 00 00 - Communications.

1.06 COORDINATION

Comply with Section 27 00 00 - Communications.

PART 2 - PRODUCT

2.01 QUANTITY DETERMINATION

Comply with Section 27 00 00 - Communications.

2.02 HORIZONTAL CABLE

Furnish all required horizontal cable - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Horizontal Cable."

2.03 VOICE CROSS-CONNECT CABLING

Furnish all horizontal cable required to support the voice services cross-connect system - Reference: 27 11 19 – Communications Termination Blocks and Patch Panels.

PART 3 – EXECUTION

3.01 GENERAL

A. All cable runs shall be installed per manufacturer's installation instructions.

B. Cable installation is “home-run” between the modular jack termination of the cable at the faceplate drop to the patch panel modular jack termination in its assigned TR.

1. Each cable shall be installed without any splices.

2. Each cable shall be installed without intermediate termination points unless approved by COS or his/her designate in writing.

C. The total length of any horizontal station cable from the modular jack termination of the cable at the drop faceplate to the patch panel modular jack termination in its assigned TR shall not exceed ninety meters (90m) - two hundred ninety-five feet (295’) - unless approved by COS or his/her designate in writing.

3.02 CEILING TILE

A. Ceiling tile shall be removed as necessary for the cable installation and put back in place without damaging or soiling any of the tiles or supporting framework.

B. Ceiling tile shall be handled so no fingerprints or marks are left on the tiles, and the tiles are not damaged in any way.

C. The Contractor is responsible for the cost of repair or replacement of any tile or ceiling tile support/framework hardware that is damaged or soiled by the Contractor.

3.03 HORIZONTAL CABLE PLACEMENT

A. No cable shall run unsupported by conduit, cable tray, hangers, or other specified support for distances greater than five feet (5’).

B. No cable shall be attached to the suspended ceiling structure or laid directly on the ceiling tiles or hard lid as a means of support, and the bottom of a cable or cable bundle shall be minimum of six inches (6") above the ceiling tile grid.

C. No cable or cable bundle shall be supported by or attached by any means to fire sprinkler heads, delivery system hardware, environmental sensor system hardware, or the exterior of any conduit, ladder rack, or cable tray. Cable shall be supported by systems specifically installed for cable support.

D. Where cable being installed is not enclosed in conduit or cable tray, cross all electrical power circuit transport at right angles.

E. Where discontinuity of cable trays or conduit pathway occurs that causes cable or cable bundle to sag vertically three inches (3") or more, support the cable or cable bundle over the discontinuity using hangers, brackets, hooks, rings, and other applicable supporting devices specified.

F. During placement of cable runs, do not exceed manufacturer's maximum pulling tension or minimum bend radius limits.

G. Do not bundle cables in cable trays.

H. Do bundle two (2) or more cables with plenum-rated Velcro ties that are snug but which do not deform the cable geometry as follows:

    1. Whenever cables in cable trays leave the cable tray and enter/exit distribution conduit.

    2. Wherever cables enter a TR. Maintain bundling with the TR.

I. Manage slack to avoid excess cable or kinking.

J Pull new pulling string through all conduits while placing new horizontal cable. Leave a pulling string in the utilized conduits for future use.

K. Do not roll or store cable reels without an appropriate underlay.

L. Cables with jackets that are chaffed, burned, have exposed internal conductor insulation, or have any bare copper (shiners) shall be replaced.

M. Maintain the following clearances from EMI sources:

    1. Unshielded power lines or equipment less than or equal to 5 kVA near cable in open or non-metal pathway: twelve inches (12").

    2. Unshielded power lines or equipment greater than 5 kVA near cable in open or non-metal pathway: twenty-four inches (24").

    3. Unshielded power lines or equipment less than or equal to 5 kVA near cable in grounded metal pathway: six inches (6").

    4. Unshielded power lines or equipment greater than 5 kVA near cable in grounded metal pathway: twelve inches (12").

    5. Power lines enclosed in grounded metal conduit less than or equal to 5 kVA near cable in grounded metal pathway: three inches (3").

6. Power lines enclosed in grounded metal conduit greater than 5 kVA near cable in grounded metal pathway: six inches (6").

7. Fluorescent fixtures near cable in open or non-metal pathway: twelve inches (12").

8. Fluorescent fixtures near cable in grounded metal conduit: six inches (6").

9. Motors or transformers near cable in non-metal pathway: forty-eight inches (48").

10. Motors or transformers near cable in grounded metal pathway: thirty-six inches (36").

11. Radiating coaxial cabling: six inches (6”).

N. After cable installation is complete, tested, and, if necessary, repairs made, install all required fire stopping. The ITPC or his/her designate will not accept the installation as completed until all required fire stopping has been installed and accepted as complete. See Section 27 05 41 – Fire Stopping.

3.04 VOICE CROSS-CONNECT CABLE PLACEMENT

A. This cabling system connects 48-port patch panel(s) in each rack to 110 blocks installed adjacent to the voice backbone or riser cable 110 terminations in each TR.

B. One cable shall be used for each modular jack in the patch panels. Modular jack counts are based on copper backbone/riser pair counts. Example: A 100-pair copper riser cable would require two (2) 48-port patch panels, a total of ninety-six (96) modular jack positions, and four (4) one hundred (100) pair 110 blocks - Reference: 27 11 19 – Communications Termintions Blocks and Patch Panels.

C. Bundle voice cross-connect cables separately from horizontal data cables. Do not mix with horizontal data cables.

D. Test cable as for station cabling - Reference Testing below.

3.05 TERMINATION

Comply with Section 27 11 19 - Communications Termination Blocks & Patch Panels and Section 27 15 43 - Communications Faceplates and Connectors.

3.06 EXAMINATION

Comply with Section 27 00 00 – Communications.

3.07 LABELING

A. Comply with Section 27 00 00 – Communications.

B. Label placement: Attach a label to both ends of each cable six inches (6") from the cables termination at the drop and TR patch panel port.

C. All labels shall be machine created labels. Hand labeling is not acceptable.

3.08 TESTING

Comply with Section 27 15 53 - Communications Cable Plant Testing.

3.09 AS-BUILT DRAWINGS

Comply with Section 27 00 00 – Communications.

3.10 VERIFICATION

Comply with Section 27 00 00 – Communications.

3.11 ADJUSTMENTS

Comply with Section 27 00 00 – Communications.

3.12 ACCEPTANCE

Comply with Section 27 00 00 – Communications.

END OF SECTION

SECTION 271543
COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all services, labor, materials, tools, and equipment required for the complete and proper installation of new faceplates and proper termination of new connectors specified in this section of the Division 27 specifications and accompanying construction drawings.

B. The specification sections of this Division 27 that are particularly applicable to this section include, but are not limited to, the following:

1. Section 27 00 00 - Communications

2. Section 27 06 00 - Communications Schedules

3. Section 27 11 19 - Communications Termination Blocks and Patch Panels

4. Section 27 15 13 - Communications Copper Horizontal Cabling

5. Section 27 15 53 - Cable Plant Testing

1.02 QUALITY CONTROL

Comply with Section 27 00 00 - Communications.

1.03 WARRANTIES

Comply with Section 27 00 00 - Communications.

1.04 MATERIAL SUBSTITUTIONS

Comply with Section 27 00 00 - Communications.

1.05 SUBMITTALS

Comply with Section 27 00 00 - Communications.

1.06 COORDINATION

Comply with Section 27 00 00 - Communications.

PART 2 - PRODUCTS

2.01 QUANTITY DETERMINATION

Comply with Section 27 00 00 - Communications.

2.02 FACEPLATES

Furnish all required faceplates - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Faceplates."

2.03 CONNECTORS

Furnish all required UTP data modular jacks - see Section 27 06 00 - Schedules for Communications, COS Master Pre-Approved Product/Material/Manufacturer List Index, Product/Material Category, "Modular Jacks."

PART 3 - EXECUTION

3.01 GENERAL

For all cable types, connector installation execution shall comply with connector manufacturer's installation specifications, instructions, and recommendations.

3.02 EXAMINATION

Comply with Section 27.00 00 – Communications.

3.03 FACEPLATE LABELING

A. Comply with Section 27.00 00 – Communications.

B. Modular Jack Labels and Placements: Each drop faceplate modular jack position shall be labeled with its complete modular jack number which includes the Telecommunication Room (TR), patch panel, number, and the jack number.

C. All labels shall be machine created labels, clearly legible, black letters on white background.

3.04 TESTING

Comply with Section 27 15 53 - Communications Cable Plant Testing.

3.05 AS-BUILT DRAWINGS

Comply with Section 27 15 53 - Communications Cable Plant Testing.

3.06 VERIFICATION

Comply with Section 27.00 00 – Communications.

3.07 ADJUSTMENTS

Comply with Section 27.00 00 – Communications.

3.07 ACCEPTANCE

Comply with Section 27.00 00 – Communications.

END OF SECTION

SECTION 271553
COMMUNICATIONS CABLE PLANT TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials, tools, field-test instruments and equipment required for the complete testing, identification and administration of the work called for in the Contract Documents.

B. In order to conform to the overall project event schedule, the cabling contractor shall survey the work areas and coordinate cabling testing with other applicable trades.

C. In addition to the tests detailed in this document, the contractor shall notify the ITPC or his/her designate of any additional tests that are deemed necessary to guarantee a fully functional system. The contractor shall carry out and record any additional measurement results at no additional charge.

D. All specifications and conjoined construction drawings issued as part of the construction documentation for this project are applicable to this Division 27 and this section. Those specifications that are particularly applicable to this section include, but are not limited to, the following:

1. Division 26 – Electrical
2. Section 27 00 00 - Communications
3. Section 27 06 00 - Schedules for Communications
4. Section 27 11 00 - Communications Equipment Room Fittings
5. Section 27 11 19 - Communications Termination Blocks and Patch Panels
6. Section 27 13 00 - Communications Backbone Cabling
7. Section 27 15 43 - Communications Faceplates and Connectors

1.2 SCOPE

A. This Section includes the minimum requirements for the test certification, identification and administration of backbone and horizontal optical fiber cabling.

B. This Section includes minimum requirements for:

1. Fiber optic test instruments
2. Fiber optic testing
3. Identification
    a) Labels and labeling
4. Administration
    a) Test results documentation
    b) As-built drawings

C. Testing shall be carried out in accordance with this document. This includes testing the attenuation and polarity of the installed cable plant with a certifying optical loss test set

(OLTS) and the testing of fiber splices, except for pigtail splicing, with an optical time domain reflectometer (OTDR).

D. Testing shall be performed on each cabling link (connector to connector).

E. All tests shall be documented including OLTS dual wavelength attenuation measurements for multimode and singlemode links and OTDR traces and event tables for multimode and singlemode links.

1. Documentation shall include optical length measurements.

1.3 QUALITY CONTROL

A. Comply with section 27 00 00.

B. Trained technicians who have successfully attended an appropriate training program, which includes testing with an OLTS and an OTDR and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

1. Manufacturer of the fiber optic cable and/or the fiber optic connectors.

2. Manufacturer of the test equipment used for the field certification.

C. The ITPC or his/her designate shall be invited to witness and/or review field-testing.

1. The ITPC or his/her designate shall be notified of the start date of the testing phase five (5) business days before testing commences.

2. The ITPC or his/her designate will select a random sample of 5% of the installed links. The ITPC or his/her designate shall test these randomly selected links and the results are to be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor shall repeat 100% testing at no cost to COS.

D. Comply with Section 27 00 00 - Communications.

1.4 MATERIAL SUBSTITUTIONS

Comply with Section 27 00 00 - Communications.

1.5 SUBMITTALS

A. Manufacturers catalog sheets and specifications for fiber optic field-test instruments including Certifying optical loss test sets (OLTS; power meter and source) and optical time domain reflectometer (OTDR).

B. A schedule (list) of all optical fibers to be tested.

C. Sample test reports

D. Comply with Section 27 00 00 - Communications

1.6 ACCEPTANCE OF TEST RESULTS

A. Comply with section 27 00 00.

B. Each cabling link shall be in compliance with the following test limits:

1. Optical loss testing

a) Multimode and Singlemode links

1) The link attenuation shall be calculated by the following formulas as specified in ANSI/TIA-568-C.0.

(i) Link Attenuation (dB) = Cable_Attn (dB) + Connector_Attn (dB) + Splice_Attn (dB)

(ii) Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)

(iii) Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)

(iv) Maximum allowable connector_loss = 0.4 dB

(v) Splice_Attn (dB) = number_of_splices * splice_loss (dB)

(vi) Maximum allowable splice_loss = 0.05 dB

(vii) The values for the Attenuation_Coefficient (dB/km) are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation coefficient (dB/km)	Wavelength (nm)	Attenuation coefficient (dB/km)
Multimode 62.5/125 µm	850	3.5	1300	1.5
Multimode 50/125 µm	850	3.5	1300	1.5
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5

2. OTDR testing not required if fiber passes required optical loss testing.

a) Reflective events (connections) shall not exceed 0.4 dB.

b) Non-reflective events (splices) shall not exceed 0.05 dB.

C. All installed cabling links shall be field-tested and pass the test requirements and analysis as described in Part 3. Any link that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link meets performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with Part 3.

D. Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of COS.

PART 2 - PRODUCTS

2.1 OPTICAL FIBER CABLE TESTERS

A. The field-test instrument shall be within the calibration period recommended by the manufacturer.

B. Certifying Optical loss test set (OLTS)

1. Multimode optical fiber light source

a) Provide dual LED light sources with central wavelengths of 850 nm (±30 nm) and 1300 nm (±20 nm)

b) Output power of –20 dBm minimum.

c) The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test

equipment or by use of an external mandrel wrap (as described in clause E.7 of ANSI/TIA-568-C.0) with a Category 1 light source.

d) Acceptable manufacturers

1) Fluke Networks DTX-8000 or Equal.

2. Singlemode optical fiber light source

a) Provide dual laser light sources with central wavelengths of 1310 nm (±20 nm) and 1550 nm (±20 nm).

b) Output power of –10 dBm minimum.

c) Acceptable manufacturers

1) Fluke Networks DTX-8000 or equal

3. Power Meter

a) Provide 850 nm, 1300/1310 nm, and 1550 nm wavelength test capability.

b) Power measurement uncertainty of ± 0.25 dB.

c) Store reference power measurement.

d) Save at least 100 results in internal memory.

e) PC interface (serial or USB).

f) Acceptable manufacturers

1) Fluke Networks (Fluke DTX-8000 or equal).

4. Optional length measurement

a) An OLTS that is capable of measuring the optical length of the fiber shall be used.

C. Optical Time Domain Reflectometer (OTDR)

1. Multimode OTDR

a) Wavelengths of 850 nm (± 20 nm) and 1300 nm (± 20 nm).

b) Event dead zones of 3.7 m maximum at 850 nm and 1300 nm.

c) Attenuation dead zones of 10 m maximum at 850 nm and 13 m maximum at 1300 nm.

d) Distance range not less than 2000 m.

e) Dynamic range at least 10 dB at 850 nm and 1300 nm

2. Singlemode OTDR

a) Wavelengths of 1310 nm (± 20 nm) and 1550 nm (± 20 nm).

b) Event dead zones of 3.5 m maximum at 1310 nm and 1550 nm.

c) Attenuation dead zones of 10 m maximum at 1310 nm and 12 m maximum at 1550 nm.

d) Distance range not less than 10000 m.

e) Dynamic range at least 10 dB at 1310 nm and 1550 nm

3. Acceptable manufacturers

a) Fluke Networks or equal

2.2 ADMINISTRATION

A. Administration of the documentation shall include test results of each fiber link.

B. The test result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.

C. The test result records saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records.

PART 3 – EXECUTION

3.1 GENERAL

A. All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.

B. All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.

3.2 OPTICAL FIBER CABLE TESTING

A. Field-test instruments shall have the latest software and firmware installed.

B. Link test results from the OLTS shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.

C. Testing shall be performed on each cabling segment (connector to connector).

D. Testing of the cabling shall be performed using high-quality test cords of the same fiber type as the cabling under test. The test cords for OLTS testing shall be between 1 m and 5 m in length.

E. Optical loss testing

1. Backbone link

a) Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper or the equivalent method.

b) Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper or the equivalent method.

c) Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

d) Use the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1 or the equivalent method. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

e) Each fiber link shall be tested in both directions.

F. Polarity Testing

1. Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with Clause E.5.3 of ANSI/TIA-568-C.0. The polarity of the paired duplex fibers shall be verified using an OLTS.

3.3 TEST RESULTS DOCUMENTATION

A. Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”. The file format, CSV (comma *separated value), does not provide adequate protection of these records and shall* not be used. PDFs shall not be used

B. The test results documentation shall be available for inspection by COS or the ITPC during the installation period and shall be passed to the ITPC within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as-built information.

C. The database for the complete project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD-ROM prior to the ITPC acceptance of the building. This CD-ROM shall include the software tools required to view, inspect, and print any selection of the test reports.

D. Circuit IDs reported by the test instrument should match the specified label ID.

E. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information

1. The identification of the customer site as specified by the end-user
2. The name of the test limit selected to execute the stored test results
3. The name of the personnel performing the test
4. The date and time the test results were saved in the memory of the tester
5. The manufacturer, model and serial number of the field-test instrument
6. The version of the test software and the version of the test limit database held within the test instrument
7. The fiber identification number
8. The length for each optical fiber
    a) The index of refraction used for length calculation when using a length capable OLTS
9. Test results to include OLTS attenuation link measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).
10. The overall Pass/Fail evaluation of the link-under-test for OLTS measurements

END OF SECTION

SECTION 283100
FIRE ALARM / EMERGENCY VOICE ALARM COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections shall form a part of this Section, with the same force and effect as though repeated here.

1.2 DESCRIPTION:

A. This section of the specifications includes the furnishing, installation, connection and programming of new microprocessor controlled, networked addressable reporting emergency voice alarm communication system fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to an emergency voice alarm communication system fire alarm panel, voice amplification power supplies, a voice alarm microphone, alarm initiating devices, alarm notification appliances, auxiliary monitoring and control devices.

B. This Section includes the furnishing of all labor, equipment, materials, and performance of all operations associated with the installation of the Fire Alarm / Emergency Voice Alarm Communication System as required by the drawings and specified herein.

1.3 SCOPE:

A. The Contractor shall furnish and install booster power panels, initiation devices and circuits, notification appliances and circuits, control relays, monitor modules and supervisory devices, as required to accomplish this intent whether or not specifically shown or specified.

B. The complete installation shall conform to the applicable sections of NFPA 72, state code requirements and the 2022 California Electrical Code with particular attention to Article 760.

C. The work specified herein shall be coordinated with the related work as specified elsewhere under the project specifications.

1.4 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. General:

1. Five copies of all submittals shall be submitted to the Architect/Engineer for review.

2. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

C. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

3. Show remote annunciator(s) layout, configurations, and terminations.

4. Shop drawings shall show valid Contractor’s C-10 license, wet-signed by C-10 license holder.

D. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manual listing the manufacturer's name(s) including technical data sheets.

2. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.

3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

E. Certifications:

1. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.5 WARRANTY

A. All work performed and all material and equipment furnished under this Contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one-year period shall be included in the submittal bid and is part of this Contract.

1.6 APPLICABLE STANDARDS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with these standards.

1. 2022 NFPA 72 National Fire Alarm Code
2. 2022 California Electrical Code (CEC)
3. 2022 California Fire Code (CFC)
4. 2022 California Mechanical Code (CMC)
5. 2022 California Building Code (CBC)
6. Underwriters Laboratories Inc. (UL) - USA:
7. California State Fire Marshal
8. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

1. UL Underwriters Laboratories Inc.
2. CSFM California State Fire Marshal

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. This emergency voice alarm communication and fire alarm system design is based on the use of microprocessor-based addressable emergency voice alarm communication and fire alarm control equipment, initiation devices and notification appliances equipment manufactured by Gamewell-FCI.

2.2 EMERGENCY VOICE ALARM COMMUNICATION AND FIRE ALARM CONTROL PANEL (FACP):

A. The Fire Alarm Control Panel shall be the Gamewell-FCI E3 Series Expandable Emergency Evacuation Addressable Fire Control Panel. The Fire Alarm Control Panel shall have the capacity to support ten (10) separate addressable signal loop circuits. The fire alarm control panel shall be complete with cabinets, batteries, battery charger and all miscellaneous components required for a complete and fully functional networked fire alarm system. In addition the fire alarm control panel shall include the following:

1. One (1) ILI-MB-E3 Intelligent Loop Interface – Main Board;

2. Four (4) ILI-S-E3 Intelligent Loop Interface – Expansion Boards;

3. Two (2) LCD-E3 LCD Keypad Displays;

4. One (1) DACT-E3 Digital Alarm Communicator Transmitter;

5. One (1) PM-9 Power Supply Module.

6. One (1) INI-VGX Intelligent Network Voice Gateway

B. Digital Alarm Communicator Transmitter (DACT)

1. Listed and labeled under UL 864 and NFPA 72.

2. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP panel, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising two lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

3. The DACT shall be Carrier Information Code (CIC) compliant and shall transmit all popular transmission formats, including CID and SIA, and shall have a sixteen digit telephone number field. The Contractor shall coordinate with the District's UL Listed central monitoring station and ensure compatible transmission format.

4. Self Test: Conducted automatically every 24 hours with report transmitted to central station.

C. Batteries:

1. Batteries shall be maintenance free, VRLA AGM lead-acid type.

2. Batteries shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 15 minutes of alarm upon a normal AC power failure.

3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

D. Dual Path Cellular and Internet Fire Alarm Communicator

1. Provide a UL Listed UL 864 and UL 1610 compliant, CSFM certified, dual path 5G LTE-M cellular and LAN Internet connected universal fire alarm communicator.

2. The dual path cellular and Internet Fire Alarm communicator shall connect to the Fire Alarm Panel DACT and shall be configured with cellular primary and internet/LAN secondary communication channels.

3. The dual path cellular and Internet Fire Alarm communicator shall be powered by 24Vdc and may be connected to auxiliary 24Vdc power from the fire alarm

control panel or through a 120V:24V plug-in transformer power supply provided by the manufacturer with the unit.

4. Antenna: 50-ohm, with female TNC connector.

5. Manufacturer: Telguard

6. Model: TG-7FE

2.3 INITIATION DEVICES

A. Manual Pull Stations

1. Manual Pull Station

a. Manual Pull Stations shall be the type that are acceptable to the DSA and that meet the DSA interpretation of ADA requirements for manual pull stations.

1) Manual Pull Stations shall not require tight grasping, pinching or twisting of the wrist, per CBC 11B-309.4.

2) Manual Pull Stations shall have Braille text operating instructions molded into the case.

b. Manual Pull Stations may be addressable devices or conventional non-addressable devices that are individually monitored through an addressable monitor module.

c. Manual Pull Stations shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

d. All operated stations shall have a positive, visual indication of operation that cannot be reset without the use of a key.

e. Manual Stations shall be constructed of LEXAN (or polycarbonate equivalent) with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.

f. Stations shall be suitable for surface mounting or semi-flush mounting.

B. Smoke Detectors

1. Addressable Photoelectric Smoke Detectors

a. Smoke detectors shall be addressable and shall connect with two wires to the Fire Alarm Control Panel Signaling Line Circuit.

b. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density.

c. The detectors shall be low profile ceiling-mount and shall include a twist-lock base.

d. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test

may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel.

e. The detectors shall store an internal identifying code that the control panel shall use to identify the type of detector.

f. The detectors shall provide an alarm and power LED. The LED shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. The LED is placed into steady illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.

C. Duct Smoke Detectors

1. Duct smoke detectors shall be the 120VAC type. Provide one addressable monitor module at each duct smoke detector. Each duct smoke detector shall be individually monitored by the fire alarm system though the addressable monitor module and shall report only as a supervisory signal to the supervising station per California Fire Code, Article 907.3.1.

2. A listed remote test and reset switch shall be furnished and installed for each duct smoke detector.

D. Waterflow Switches (System Sensor WFD Series)

1. Waterflow switches shall be integral, mechanical, non-coded, non-accumulative retard type.

2. Waterflow switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds.

3. Waterflow switches shall be located a minimum of one (1) foot from a fitting that changes the direction of the flow and a minimum of three (3) feet from a valve.

4. Each waterflow switch shall be individually monitored by an addressable monitor module that is connected to the initiation device circuit of the fire alarm system.

E. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.

2. Each Post Indicator Valve (PIV) shall be equipped with a supervisory switch.

3. Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.

4. The mechanism shall be contained in a weatherproof aluminum housing, that shall provide a 3/4-inch tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.

5. Switch housing to be finished in red baked enamel.

6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.

7. Each valve supervisory switch shall be individually monitored by an addressable monitor module that is connected to initiation device circuit of the fire alarm system.

2.4 ADDRESSABLE MODULES, CONTROL RELAYS, AND AUXILIARY DEVICES

A. Addressable Monitor Module

1. Addressable Monitor modules shall be provided to connect one supervised IDC (zone) of conventional Alarm Initiating Devices (any N.O. dry contact device) to the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loop.

2. The monitor module shall be mounted in a 4-inch square, 2-1/8" deep electrical box.

3. The IDC (zone) may be wired for Style D (Class A) or Style B (Class B) operation. The Monitor module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the Fire Alarm Control Panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the Monitor module is operational and in regular communication with the control panel.

B. Addressable Control Module

1. Addressable Control Modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual appliances or audio speakers.

2. The Control Module shall be mounted in a standard 4-inch square, 2-1/8" deep electrical box.

3. The NAC shall wire in a Class B (Style Y) or Class A (Style Z) fashion. Each control module shall support up to 1 Amp of Inductive or 2 Amps of Resistive Audible/Visual signals.

4. Audible/Visual power shall be provided by a separate notification appliance circuit from the main Fire Alarm Control Panel or from a fire alarm expander panel.

5. The Control Module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the Control Panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the Control Module is operational and is in regular communication with the control panel.

6. A magnetic test switch shall be provided to test the module without opening or shorting its NAC circuit wiring.

C. Auxiliary Relays

1. Auxiliary relay coils shall be rated at 120V and contacts shall be rated for 120V, 20A, and shall conform to UL 864.

2. Auxiliary relays shall be listed with the California State Fire Marshal (CSFM).

2.5 FIRE ALARM BOOSTER POWER PANELS (FABP)

A. Fire Alarm Booster Power Panels shall provide four (4), 24VDC Class A or Class B notification appliance circuits, with a total capacity of 8 amperes. The power supply shall be a power limited, regulated power supply and be listed for use with 24VDC notification appliances.

B. Fire Alarm Booster Power Panels shall have 7AH batteries and an integral battery charger capable of maintaining 7AH batteries.

C. Fire Alarm Booster Power Panels shall be supervised for ground fault, overcurrent, open circuits and low battery conditions.

D. Batteries:

1. Batteries shall be maintenance free, VRLA AGM lead-acid type.

2. Batteries shall have sufficient capacity to power connected notification appliances for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

2.6 NOTIFICATION APPLIANCES

A. Microphone Assembly: Include the following items:

1. Mounting cabinet

2. Interconnect cable for connection of microphone to INI-VG.

3. 1 noise canceling microphone with push-to-talk button.

B. Speakers

1. ADA/NFPA/ANSI compliant

2. Complies with OSHA 29 Part 1910.165

3. 24 VDC with wide UL “Regulated Voltage” using filtered DC or unfiltered VRMS input voltage

4. Field selectable taps for 25 or 70 VRMS operation from 1/8 watt up to 2 watts (indoor), 1/8 watt up to 8 watt (outdoor)

5. High efficiency design for maximum output at minimum wattage across a frequency range of 400 to 4000 HZ

6. Fast installation with IN/OUT screw terminals using #12 to #18 AWG wires

7. Optional Extender (E60 Ext) is for mounting to 4” backboxes with no extension ring.

8. Weatherproof with extended temperature range of –40°F to 150°F (-40°C to 66°C)

C. Strobes

1. Strobes are visual notification appliances for the hearing impaired.

2. Strobes shall operate on 24 VDC nominal.

3. Strobes shall meet the requirements of the ADA (Americans with Disabilities Act) as well as UL Standard 1971 and CBC.

4. Strobes shall be flush mounted in an electrical box in accordance with the manufacturer’s installation instructions.

D. Combination Speaker/Strobes

1. ADA/NFPA/ANSI compliant

2. Complies with OSHA 29 Part 1910.165

3. Ceiling mount strobe models are available with field selectable candela settings of 15/30/75/95cd or 115/177cd (multi-candela models)

4. Strobes produce 1 flash per second over the regulated voltage range

5. 24 VDC with wide UL “Regulated Voltage” using filtered DC or unfiltered VRMS input voltage

6. Field selectable taps for 25 or 70 VRMS operation from 1/8 watt up to 2 watts

7. High efficiency design for maximum output at minimum wattage across a frequency range of 400 to 4000 HZ

8. Fast installation with IN/OUT screw terminals using #12 to #18 AWG wires

9. Optional Extender (E60 Ext) is for mounting to 4” backboxes with no extension ring.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Installation shall be in accordance with the CEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the equipment manufacturer.

B. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

3.2 WIRING INSTALLATION

A. Fire Alarm System initiation device circuits and notification appliance circuits shall be installed in conduit. The minimum conduit size shall be ¾".

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. Power-Limited Circuits: CEC, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

D. Each Fire Alarm Control Panel and Fire Alarm Booster Power Panel shall be connected to a separate dedicated 120V, 20A branch circuit with a dedicated neutral conductor and an equipment grounding conductor. Provide a circuit breaker lock-on devices on each circuit breaker supplying fire alarm system equipment and provide a red label that reads: "FIRE ALARM / ECS" adjacent to the circuit breaker.

E. Fire Alarm Booster Power Panel Primary Power wiring shall be 12 AWG copper.

3.3 GROUNDING

A. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.

C. The Fire Alarm Panel cabinet shall be grounded with an equipment grounding conductor that is run with the primary power wiring. Cabinet doors shall be bonded to cabinets with braided grounding straps of sufficient length to allow the cabinet door to fully open.

3.4 PROGRAMMING

A. The Contractor shall provide all programming of the Fire Alarm System to result in a complete and functional Fire Alarm System in accordance with all applicable codes and standards, and as specified herein.

B. Zone Programming:

1. The Contractor shall provide zone programming for the Fire Alarm System as follows:
    a. Each building shall be programmed as a separate zone.
    b. Each floor of a multi-story building shall be programmed as a separate zone.
    c. Each section of a floor in a building that is separated by area separation walls or by horizontal exits shall be programmed as a separate zone.
    d. Additional zones shall be programmed where deemed necessary by the authority having jurisdiction.
2. Zone programming for the Fire Alarm System shall match the zone map (refer to Article titled, IDENTIFICATION AND DOCUMENTATION, for zone map requirements.)

C. LCD Annunciation

1. The Contractor shall program the LCD annunciator at the Fire Alarm Control Panel and remote LCD annunciators to annunciate the following information:
    a. The zone that is in alarm.
    b. The type of alarm initiating device:
        1) Manual Pull Station;
        2) Smoke Detector;
        3) Other.
    c. The location of the device that is in alarm (refer to Article titled, IDENTIFICATION AND DOCUMENTATION, for device map location requirements.)

D. Controls

1. The Contractor shall utilize addressable control relays and auxiliary relays and shall program the fire alarm system control panel to cause the closure of fire/smoke dampers and provide a signal for HVAC units to shut down.

E. Remote Monitoring Station

1. The contractor shall coordinate with the Remote Monitoring Station and program the system to report the number of points purchased by the Owner. Prior to the start of programming, Contractor shall verify how many point signals, above and beyond minimum code requirements, shall be transmitted to the monitoring station with Owner.
2. Where the new fire alarm control panel is tied to an existing fire alarm control panel, the Contractor shall program the existing fire alarm panel to accept and respond to alarm and trouble initiation signals from the new fire alarm control panel.

3.5 IDENTIFICATION AND DOCUMENTATION

A. Zone Map – The Contractor shall create an 11”x17” site plan identifying each building and identifying the zones. The zone map shall be created by a CAD program and shall be posted under plastic cover at the location of the fire alarm control panel.

B. Device Location Map – For each building the Contractor shall create an 11”x17” floor plan of the building showing the location of each device and the device address as it is annunciated at the control panel and remote annunciator. The device location map shall be created by a CAD program and shall be posted under plastic cover at the location of the fire alarm control panel or fire alarm booster power supply within each building.

C. Documentation Cabinet – Provide and install a documentation cabinet marked “FIRE ALARM SYSTEM RECORD DOCUMENTS” located adjacent to each fire alarm control unit.

D. Provide a red label at each branch circuit breaker that supplies power to the Fire Alarm Control Panel and Fire Alarm Booster Power Panels that reads: "FIRE ALARM / ECS”.

E. Provide a label on the inside of the cabinet door of each fire alarm cabinet that is supplied by a branch circuit that identifies the panel, circuit number and location of the power panel that is supplying that fire alarm cabinet.

3.6 ACCEPTANCE TESTING AND CERTIFICATION

A. Prior to the final acceptance test provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system:

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

2. Open initiating device circuits and verify that the trouble signal actuates.

3. Open and short signaling line circuits and verify that the trouble signal actuates.

4. Open and short Notification Appliance Circuits and verify that trouble signal actuates.

5. Ground all circuits and verify response of trouble signals.

6. Check presence and audibility of tone at all alarm notification devices.

7. Check installation, supervision, and operation of all addressable smoke detectors using the Walk Test.

8. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

9. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying the controls performance by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

B. At the final inspection a manufacturer-trained representative shall demonstrate that the system functions properly in every respect.

C. Upon completion of the installation, a test of the entire system shall be performed in the presence of the Inspector of Record and the local authority having jurisdiction. The local Fire Marshal shall be notified and invited to witness the test a minimum of 72 hours prior to the test. Components and functions of the system shall be tested and an Inspection and Testing Record Form shall be generated in accordance with NFPA 72 indicating the proper functioning of each component of the system.

D. If devices or other components of the system fail during testing the defective devices or components shall be removed and immediately replaced with functional units and the test shall be repeated.

E. Complete the NFPA 72 Record of Completion, testing all devices and appliances. Provide a copy of the completed Record of Completion to the Owner, Architect, Local Fire Authority and DSA via the Project Inspector.

3.7 INSTRUCTION

A. Provide instruction as required for operating the system. "Hands-on" demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided. The Contractor and/or the Systems Manufacturer's representatives shall provide a typewritten "Sequence of Operation" to the Owner.

B. The Contractor shall furnish a full size complete set of fire alarm “as-built” record drawings on bond paper showing locations of all devices and the proper address of the device as it is displayed on the LCD annunciator at the fire alarm control panels and/or remote annunciators. This “as-built” set shall be located adjacent to the fire alarm control panel in the document cabinet for the reference of the Authority Having Jurisdiction.

3.8 CLOSEOUT SUBMITTAL

A. The Contractor shall submit closeout submittal documentation consisting of the following items:

1. Full size fire alarm “as-built” record drawings; drawings shall show valid Contractor’s C-10 license, wet-signed by C-10 license holder.

2. Device cut sheets and CSFM listing services;

3. A copy of the Fire Alarm System Record of Completion signed by the Installer and the Inspector of Record;

4. Owner's Manuals and Operating Instructions.

END OF SECTION 283100

SECTION 31100
SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely clear and demolish all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. RELATED SECTIONS:

   1. Contract General Conditions and Division 1, General Requirements
   2. Section 312000 – Earthwork: Excavation, Filling, and Grading
   3. Section 312222 – Soil Materials
   4. Section 312333 – Trench Excavation and Backfill

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. In accordance with Specification Section GENERAL REQUIREMENTS, and the following:
      a. Materials and equipment used for this project shall comply with the current applicable regulations of the California Air Resources Board [CARB] and the Environmental Protection Agency [EPA].

B. Meetings:

   1. Minimum agenda shall be to discuss coordination of upcoming work, review the work progress, discuss field observations, identification of any potential problems which may impede planned progress; corrective measures to regain projected schedule; and maintenance of quality and work standards.
   2. Meetings shall include Pre-Clearing and Demolition Meetings.
   3. Participants (or designated representative of) invited to attend each of the above meetings shall be as follows:
      a. Contractor.
      b. Owner.
      c. Architect.
      d. Testing Laboratory.

e. Local Governing Authorities as applicable.
f. Utility Representatives as applicable.
g. Owner's Inspector.
h. Clearing and Demolition Subcontractor.
i. Other subcontractors, as appropriate (including any accessory subcontractors).

1.4 PROJECT CONDITIONS OR SITE CONDITIONS

A. Dust Control
1. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.
2. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. Contractor shall be responsible for preparing said Dust Control Plan, submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.
3. No construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan, if one is required.
4. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.
5. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefor.

B. Existing Conditions:
1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives, walks or occupied facilities.
a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and Authorities having jurisdiction.
b. Provide alternate routes around closed or obstructed traffic ways if required by Authorities having jurisdiction.

3. Locate and identify utilities.
a. Call a Local Utility Locator Service (USA – "Underground Service Alert" – [800] 227-2600) for the task of locating any applicable utilities in the area where the Project is located.

4. Carefully remove items indicated to be salvaged and store on Owner's premises at the Owner's direction.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordination:
   1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

B. Protection:
   1. Protect and maintain all benchmarks and survey control points from disturbance during clearing and demolition operations.
   2. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties.
   3. Furnish and install temporary protection/barrier fencing surrounding the limits of demolition.
   4. Protect trees, plant growth, and features not specifically designated for removal. Locate and clearly flag trees and vegetation to remain or to be relocated.
   5. Protect existing improvements designated to remain from damage during construction.
      a. Restore damaged improvements to their original condition, as acceptable to the Owner.

3.2 CONSTRUCTION

A. Vegetation, Shrub, Topsoil, Weed Removal:
   1. Remove weeds and rooted topsoil to a minimum three (3) inch depth and temporarily stockpile as needed for re-use in finished grading of landscape areas. Remove excess material from the site.
   2. Where existing vegetation is to be replaced by new materials, remove contaminated or excess soil from the site and legally dispose of off-site.

B. Existing Site Improvements Removal:
   1. Remove existing above and below grade improvements as necessary to facilitate new construction.
      a. Remove concrete slabs, sidewalk, curbs, mow strips, gutters, and fence post footings.
         1) Neatly saw-cut length of existing pavement to remain before removing existing pavement unless existing full-depth joints coincide with line of demolition. Saw-cut faces vertically.

      b. Remove indicated utility improvements within the limits of construction.
         1) Excavate for and disconnect utilities designated to be removed. Seal or cap off underground.

2) Coordinate removal and/or relocation of utilities with the appropriate utility agencies.

c. Where existing underground utilities, irrigation pipes, wells, leach fields, or underground tanks are encountered, they must be removed or moved to a point at least 5 feet horizontally outside the proposed building and 3 feet horizontally outside the concrete flatwork or pavement construction areas. All resultant cavities must be backfilled with engineered fill.

d. Remove concrete slabs, foundations, and utilities within building footprint.

C. Existing Utilities to Remain or be Relocated:

1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   a. Notify Architect and the Owner not less than seven (7) days in advance of proposed utility interruptions.
   b. Arrange to shut off indicated utilities with utility companies and Owner.

D. Disposal:

1. Legally dispose of all debris (surplus soil materials, unsuitable topsoil, obstructions, demolished materials, waste materials, trash, etc.) resulting from clearing, grubbing, demolition and from construction. Disposal of all materials shall be at a location secured by the Contractor off of the Owner's property.

END OF SECTION

SECTION 312000
EARTHWORK: EXCAVATION, FILLING AND GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:
   1. Excavating soil and other material for surface improvements.
   2. Placing fill.
   3. Compaction of existing ground and fill.
   4. Preparation of subgrade for other improvements.
   5. Grading of soil.

B. RELATED SECTIONS
   1. Contract General Conditions and Division 1, General Requirements
   2. Section 311100 – Site Clearing
   3. Section 312222 – Soil Materials
   4. Section 312333 – Trench Excavation and Backfill

1.3 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18-inch (457 mm) Drop.

B. A Geotechnical Engineering Investigation Report has been prepared for the project by Soils Engineering, Inc.; SEI File No. 24-19596, dated June 19, 2024. A copy of the report is available (for reference only) at the cost of reproduction. Contact SEI if a copy of the report is desired.

1.4 DEFINITIONS

A. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

A. Product Data:
   1. Information indicating the source of all import material, the fill material type and where it is to be used, and approval of the District's Inspector of Record for incorporation of import material into the Work.

B. Material Test Reports:
   1. Classification of Soils.
   2. Compaction Characteristics of Soils.
   3. Density and Unit Weight of Soils in Place.
   4. Imported fill shall be tested and approved by the Owner's Geotechnical Engineer prior to import to the site, including testing for compliance with Department of Toxic Substances Control (DTSC) guidelines. Said testing and certification documents shall be paid for by the Owner.

C. Project Closeout: In accordance with Specification Section PROJECT CLOSEOUT.
   1. Drawings indicating the extent and depth of all engineered fill, and overexcavation and recompaction. This information shall be a part of the Project "As-Built" and Project "Record" Documents in accordance with the Specification Section PROJECT DOCUMENTS.

1.6 QUALITY ASSURANCE

A. Installer:
   1. Qualifications:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.

B. Regulatory Requirements:
   1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:
      a. CARB — Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB].
      b. CV — City of Visalia, Codes and Ordinances
      c. EPA — Environmental Protection Agency.
      d. CAL/OSHA — Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.
      e. DTSC — Comply with all recommendations of the California Department of Toxic Substance Control (DTSC) regarding soil testing for potential contaminants.

C. Certificates:
   1. Installer's certification that all Earthwork installation meets or exceeds the requirements of this specification.
   2. Contractor's certification (on Contractor's letterhead paper) that the Earthwork materials and installation meets or exceeds the requirements of this specification.

D. Meetings:
   1. Pre-Installation: Schedule prior to the start of work.
      a. Coordinate the work with other work being performed.
      b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.

   2. Progress: Scheduled by the Contractor during the performance of the work.
      a. Review for proper installation of work progress.
      b. Identify any installation problems and acceptable corrective measures.
      c. Identify any measures to maintain or regain project schedule if necessary.

   3. Completion: Scheduled by the Contractor upon proper completion of the work.
      a. Inspect and identify any problems which may impede issuance of warranties or guaranties.
      b. Maintain installed work until the Notice of Substantial Completion has been filed.

1.7 COORDINATION

A. Coordinate work with Owner's personnel.

B. Provide required notification to the Owner and Geotechnical Engineer or the Engineer of Record so that a representative from the Owner's Geotechnical Engineering consultant can be present for all excavation, filling and grading operations to test and observe earthwork construction.

C. Verify that the location of existing utilities has been indicated at work site by utility authorities, by Owner, and as specified on the Plans.

1.8 EXISTING CONDITIONS

A. Existing Conditions:
   1. Examine the site and verify conditions with the Drawings and Specifications. Contractor shall familiarize himself with existing site conditions and any changes that have occurred at the site since the preparation of the contract documents and shall be responsible to account for any such changes in the price bid for this work.
   2. Thoroughly investigate and verify conditions under which the Work is to be performed.

3. Locate and identify utilities:
    a. Call a Local Utility Locator Service (USA - “Underground Service Alert” – [800] 227-2600) for the task of locating any applicable off-site and on-site utilities in the area where the Project is located.

4. No allowance for Extra Work will be granted resulting from negligence or failure to meet requirements of this Section.

B. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete flatwork, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunk line utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. Under similar circumstance, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

D. Determine exact location of existing buried utilities by:
1. Marking on ground or pavement surface the alignment and extent of the facilities and the probable location of existing utilities using construction plans and existing surface features.
2. Requesting Underground Service Alert (USA) to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations and notify Owner of said request concurrently.
3. Confirm exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

E. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner’s personnel.

F. Provide Field Engineering to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under this Contract, submit detailed information to the Engineer for review and direction.

G. Maintain all existing utility mains and service lines in constant service during construction of the Work.

H. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work, and coordinate the timing of any such disruptions in advance with the District.

I. Existing soils are considered to have a low corrosive potential to buried metal objects.

J. Existing soils are considered to have a very low expansion potential.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.
   1. All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, or vegetative ground cover.
   2. All land clearing, demolition, grubbing, scraping, excavation, land leveling, grading, and cut and fill activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by pre-soaking.
   3. When materials are transported off-site, all material shall be covered, effectively wetted to limit visible dust emissions or at least six inches of freeboard space from the top of the container shall be maintained.
   4. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at least once every 24 hours when operations are occurring. The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. The use of blower devices is expressly forbidden.
   5. Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/ suppressant.
      a. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.
      b. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. If required, Contractor shall be responsible for preparing said Dust Control Plan, submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.
      c. If a dust control plan is required, no construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan.
      d. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.

e. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefore

B. Burning: No burning will be allowed on-site.

C. Rain: Work under this section shall not be started or maintained under threat of rain, unless the work is not affected by the rain.

D. Do not place fill during weather conditions which will alter moisture content of fill materials sufficiently to make compaction to the specified densities difficult or impossible.

E. When reference is made to SWPPP (Storm Water Pollution Prevention Plan), if any within this Project Manual, then comply with all environmental protection requirements included therein.

F. In accordance with EPA, CARB and CV.

G. Protection:
1. Protect cut and fill areas to prevent water running into excavation. Maintain areas free of water. Remove seeping water immediately by pumps. Provide dewatering as necessary.
2. Protect cut slopes from erosion due to precipitation and other sources of runoff.
3. Protect utilities to remain within the construction area and special construction. If utility lines are uncovered (water, electric, sewer, etc.) not shown on the drawings during excavation of site, notify the Architect promptly for its review and action.
4. Do not permit access to undeveloped portions of the site, nor to areas that are outside of the limits of grading.

H. Before being brought onto the site, all import soil must be sampled, tested and approved by Owner's Geotechnical Engineer. All import material must comply with DTSC recommendations and guidelines for environmentally clean soil suitable for school construction. Import testing will be provided and paid for by the Owner.

1.10 PROJECT RECORD DOCUMENTS

A. Submit under provisions of GENERAL CONDITIONS and DIVISION 1, GENERAL REQUIREMENTS.

B. Accurately record actual locations of utilities encountered including depth and horizontal location, as measured from permanent site features.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill in Turf or Other Planting Areas: Type S2 or S3 per Division 31 Specification Section SOIL MATERIALS.

B. Fill in Non-planting Areas: Type S1, S2 or S4 per Division 31 Specification Section SOIL MATERIALS.

C. Imported material: Type S3, S4 or S5 per Division 31 Specification Section SOIL MATERIALS.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

3.2 PREPARATION

A. Layout of Work:
   1. Contractor shall be responsible for all lines and grades. Layout shall be provided by a California registered Land Surveyor or Civil Engineer, at Contractor's expense.
   2. Check all benchmarks, monuments and property lines and verify locations.
   3. Locate and maintain all grade stakes.
   4. Monuments moved or displaced during grading operation are to be replaced by a California Registered Civil Engineer or Surveyor, at Contractor’s expense.

B. Locate, identify, and protect existing above and below grade utilities from damage.

C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

D. Protect existing structures, fences, curbs, sidewalks, paving and other improvements to remain from damage from excavation equipment and vehicular traffic.

E. Employ equipment and methods appropriate to the work site.

F. Protect excavated areas from drainage inflow and provide for drainage of all excavated areas.

G. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.3 SITE STRIPPING:

A. Reference is made to Division 31 Specification Section SITE CLEARING.

B. Within the areas of planned surface improvements and structures, the near surface soils containing vegetation, roots, organics, or other objectionable material must be stripped and removed from the site. Upon approval of the Geotechnical Engineer, suitable materials stripped from the site may stockpiled and incorporated into the finish fill for planting areas.

C. All areas to receive surface improvements shall be stripped to remove turf, shrubs, trees and other vegetation, along with associated root systems, concrete, wood, metal, rubbish and other unsuitable debris, and any loose, saturated or unconsolidated soil material. Striping depth is expected to be 3-inches below existing site grades. Stripping shall continue to the depth required to expose acceptable basement soils that are free from deleterious which are not suitable for Engineered Fill, as required by the Geotechnical Engineer.

3.4 EXCAVATION

A. Following clearing and stripping operations, excavate planned construction areas as specified in this Section.

B. Within the area of the planned building improvements plus at least 5-feet horizontally beyond the outside dimension of the building including footings and non-cantilevered overhangs carrying structural loads, the subgrade must be over-excavated at least 5-feet below the existing stripped subgrade surface or at least 2-feet below to the bottom of the proposed foundation elevations, whichever is deeper.

C. Within the areas of lightly loaded shallow spread foundations outside the building pad (i.e. retaining and screen walls) plus at least 2-feet horizontally beyond the outer edges of the proposed footings, the subgrade must be over-excavated at least 2-feet below the existing stripped subgrade surface or 1-foot below the bottom of the proposed foundation elevation, whichever is deeper.

D. Areas of exterior concrete slabs on grade located outside the building pad over-excavation limits plus at least 2-feet horizontally beyond the outer edges of the proposed improvements, the subgrade must be over-excavated at least 12-inches below the existing stripped subgrade surface or at least 12-inches below to the bottom of the proposed aggregate base section, whichever is deeper.

E. Areas of asphaltic concrete pavements plus at least 2-feet horizontally beyond the outer edges of the proposed improvements, the subgrade must be over-excavated at least 12-inches below the existing stripped subgrade surface or at least 12-inches below to the bottom of the proposed aggregate base section, whichever is deeper.

F. Excavation of native soils shall continue in vertical increments of 1-foot until relative compaction tests taken at excavation bottom equal or exceed 80% relative compaction.

G. Provide additional excavation as required to conform to the lines, grades and cross-sections shown on the plans.

H. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw. Remove all roots ¾" in diameter and greater.

I. Remove excess soil not to be used as fill in the Work from the site. Unless requested by Owner to be deposited at a site designated by Owner on the property, obtain a disposal site and legally dispose of said excess material, all at no additional cost to the Owner.

J. Areas disturbed by demolition must be excavated to expose undisturbed soils.

K. Excavated soils free of deleterious substances (organic matter, demolition debris, tree roots, etc.) and with less than 2% organic content by weight, may be returned to the excavations as Engineered Fill.

3.5 FILLING AND COMPACTING

A. Once clearing, stripping and over-excavation operations are complete, scarify the surface to receive fill material or improvements to a depth of 8-inches, moisture condition to near optimum or to a moisture content consistent with effective compaction and soil stability, and compact to a minimum of 90% of maximum dry density based on ASTM Test Method 1557.

B. Place and compact soil to finish subgrade of improvements to be placed thereon, or to finished surface grade where no improvements are to be placed thereon.

C. All fill required shall be placed as Engineered Fill.

D. The Contractor shall be solely responsible for securing an acceptable source of import material as required to grade the site. Reference is made to 31 20 00 1.9.H

E. On-site soils are suitable for re-use as Engineered Fill, providing they are cleansed of excessive organics (less than 2 percent by weight, ASTM D2974), debris, and fragments larger than three (3) inches in maximum dimension and meet the requirements of soil Type S4, Division 31 Specification Section SOIL MATERIALS.

F. Engineered Fill shall be moisture condition to near optimum or to a moisture content consistent with effective compaction and soil stability, placed in uncompacted layers not exceeding eight (8) inches in thickness, and compacted as specified, based on ASTM Test Method D1557.
   1. Non-vegetative surface improvement areas (structures and site concrete improvements) - To a minimum of 90% of maximum dry density.
   2. Vegetative surface improvement areas (turf and planters) - Below top twelve (12) inches - to a minimum of 90% of maximum dry density. Top twelve (12) inches - 85% of maximum dry density.

3. Pavement areas: to a minimum 95% of maximum dry density top twelve (12) inches. Below top twelve (12) inches - to a minimum of 90% of maximum dry density.

G. Maintain optimum moisture content of fill materials to attain required compaction density.

H. Additional lifts shall not be placed if the previous lift did not meet the required dry density, or if soil conditions are not stable.

I. Conform fill to the lines, grades and cross-sections shown on the plans.

J. Fill materials to conform to Division 31 Specification Section SOIL MATERIALS.

K. Provide, at no additional cost to Owner, imported soil material conforming to the requirements of Division 31 Specification Section SOIL MATERIALS, as needed to attain finished grades of Work.

L. Utilize equipment which will not disturb or damage existing utilities and other improvements.

3.6 PREPARATION OF SUBGRADE FOR SURFACE IMPROVEMENTS

A. Where concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvements, or a layer of said surface improvements, are to be constructed on the soil surface, prepare the subgrade for said improvements in accordance with this section.

B. Scarify the soil as specified and remove and dispose of (off the project site) all rocks, hardpan chunks or otherwise unsuitable material over 3-inches in size.

C. Thoroughly moisture condition and compact as described above.

D. Prior to commencing construction of surface improvements, pass a test roller of size and weight as approved by the Owner over the subgrade to establish the extent of soft or spongy areas requiring repairs.

E. Conform finished subgrade surface to the lines, grades and cross-sections shown on the plans.

3.7 FINE GRADING

A. Fine grade all finished surfaces to the lines, grades and cross-sections shown on the plans, and to blend to hard surface improvements.

B. Rake and smooth all finished surfaces not to receive hard surface improvements.

C. Use suitable stockpiled or imported topsoil for the top 12-inches of areas to receive landscape improvements.

D. Import topsoil meeting the requirements of Division 31 Specification Section SOIL MATERIALS, as required to complete finish grading.

E. Topsoil may not be used in areas requiring Engineered Fill.

3.8 TOLERANCES

A. Top surface of Subgrade for Non-Vegetative Surface Improvements or Layers thereof: Plus or minus 0.02 foot from planned elevation.

B. Top surface of Subgrade for Vegetative Surface Improvements or for Bare Ground - Plus or minus 0.05 foot of planned elevation, or as required for finish surface to match adjacent improvements or ground.

3.9 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of GENERAL CONDITIONS and/or DIVISION 1, GENERAL REQUIREMENTS.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest.

D. All retesting required as a result of failure of initial test will be performed by Owner's testing agency, at the expense of the Contractor.

3.10 PROTECTION

A. Protect graded areas from traffic, freezing, erosion, and all other sources of damage. Keep free of debris and trash.

B. Repair and re-establish grades to specified tolerances where completed or partially completed work becomes eroded, rutted, settled, or where it is damaged by subsequent construction operations or weather.

C. Where settlement occurs prior to acceptance of the work, remove and replace surface improvements, excavate, replace, and re-compact in accordance with these specifications, and restore the surface improvements.

3.11 CLEANING

A. Remove all surplus or unsatisfactory soil material, trash, and debris, and legally dispose of off of the Owner's property.

END OF SECTION

SECTION 312222
SOIL MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:
   1. Excavated (and re-used) materials and imported materials.

B. RELATED SECTIONS
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 312000 - Earthwork: Excavation, Filling and Grading
   3. Section 312333 - Trench Excavation and Backfill

1.3 SUBMITTALS

A. Samples: Submit, in air-tight containers, 10 lb. sample of Type S3, S4 and S5 fill to inspector.

B. Soil Analysis: Submit for Type S3, S4 and S5 soils to be imported.

C. Materials Source: Submit location of imported materials source. Provide materials from same source throughout the work. Change of source requires approval.

D. For imported soil, obtain Geotechnical Engineer and District approval prior to importing.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Soil Type S1: Excavated and re-used material, graded; free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.

B. Soil Type S2: Excavated and reused material, graded; free of roots, lumps greater than one inch, rocks larger than 1/2 inch, debris, weeds and foreign matter.

C. Soil Type S3: Imported topsoil, friable loam; reasonably free of roots, rocks larger than ½ inch, debris, weeds, and foreign matter.

D. Soil Type S4: Imported borrow, suitable for purposes intended, meeting the following characteristics:
   1. Percentage Retained 3” Sieve: 0
   2. Percentage Retained 1-1/2” Sieve (Building Areas): 15
   3. Percentage Retained 3/4” Sieve (Landscape Areas): 5
   4. Percent Passing #200 Sieve: <40
   5. Expansion Index: <20
   6. Plasticity Index: <14
   7. R-Value (in paved areas): >50

E. Soil Type S5: Imported sand. Natural river or bank sand (sand equivalent greater than 30), washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

2.2 SOURCE QUALITY CONTROL

A. Inspection of imported soil will be performed by the Geotechnical Engineer, at source of import and prior to being delivered to the site.

PART 3 - EXECUTION

3.1 STOCKPILING

A. Stockpile excavated or imported material onsite at location designated by project inspector.

B. Stockpile excavated or imported material in sufficient quantities to meet project schedule and requirements.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

B. Dispose of excess material off-site.

END OF SECTION

SECTION 312333
TRENCH EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Geotechnical Report prepared by Soils Engineering, Inc., File number 24-19596, dated June 19, 2024.

1.2 SUMMARY:

A. This Section includes the following:
1. Excavating trenches, holes and pits for constructing the Work.
2. Backfill and compaction.
3. Providing suitable bedding and backfill material, as specified herein.

B. RELATED SECTIONS
1. Contract General Conditions and Division 1, General Requirements.
2. Section 311100 - Site Clearing
3. Section 312000 - Earthwork: Excavation, Filling and Grading
4. Section 312222 - Soil Materials
5. Section 331200 - Water Utilities
6. Section 333000 - Site Sewer Systems
7. Section 334000 - Storm Drainage

1.3 REFERENCES

A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

1.4 DEFINITIONS

A. Utility: Any buried or above ground pipe, conduit, cable, associate devices or appurtenances, or substructure pertaining hereto.

1.5 QUALITY ASSURANCE

A. Qualifications
   1. Installer:
      a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.

B. Regulatory Requirements:

   1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:
      a. CARB — Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB].
      b. CV — City of Visalia, Codes and Ordinances
      c. EPA — Environmental Protection Agency.
      d. CAL/OSHA — Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.

C. Certificates:
   1. Installer's certification that all trench backfill installation meets or exceeds the requirements of this specification.
   2. Contractor's certification (on Contractor's letterhead paper) that the trench backfill materials and installation meets or exceeds the requirements of this specification.

D. Meetings:

   1. Pre-Installation: Schedule prior to the start of work.
      a. Coordinate the work with other work being performed.
      b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.

   2. Progress: Scheduled by the Contractor during the performance of the work.
      a. Review for proper installation of work progress.
      b. Identify any installation problems and acceptable corrective measures.
      c. Identify any measures to maintain or regain project schedule if necessary.

   3. Completion: Scheduled by the Contractor upon proper completion of the work.
      a. Inspect and identify any problems which may impede issuance of warranties or guaranties.

   4. Maintain installed work until the Notice of Substantial Completion has been filed.

1.6 COORDINATION

A. Coordinate work with Owner's personnel.

B. Verify that the location of existing utilities have been indicated at work site by utility authorities.

1.7 EXISTING UTILITIES

A. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete work, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

B. Under circumstance similar to 31 23 33/1.7A, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. Determine exact location of existing buried utilities by:
   1. Marking on ground or pavement surface the alignment and extent of the proposed facilities and the probable location of existing utilities using construction plans and existing surface features.
   2. Requesting Underground Service Alert (USA) to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations, and notify Owner of said request concurrently.
   3. Locate exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

D. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner's personnel.

E. Provide Field Engineering per Contract General Conditions and Division 1 to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under the Contract, submit detailed information to the Owner's Inspector and Engineer for review and direction.

F. Maintain all existing utility mains and service lines in constant service during construction of the Work.

G. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Fill Type S1, S2, S4 and S5, as specified in Division 31 Specification Section SOIL MATERIALS.

2.2 WARNING TAPE

A. 6” wide warning tape shall be installed over all of the pipelines as shown on the details.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

B. Protect existing structures, fences, sidewalks, curbs, and other improvements from excavation equipment and vehicular traffic.

C. Maintain and protect above and below grade utilities which are to remain.

D. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.2 EXCAVATION

A. Excavate soil required to locate existing utilities and install the work.

B. Use hand methods of excavation to locate existing utilities, and to excavate trenches, pits and holes in congested areas.

C. Employ equipment and methods appropriate to the work site. Small mechanical excavators may be used only in areas where there is sufficient space so as not to damage adjacent improvements, and where the locations of all existing utilities have been determined by hand methods of excavating.

D. Cut trenches just wide enough to enable installation and proper bedding and backfill, and to allow inspection.

E. Do not interfere with 45 degree (1:1) bearing splay of foundations.

F. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose material.

G. Excavate trenches, pits or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings. No additional payment will be made for such over-excavation and refill.

H. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure, and backfill the space with Type S2 or S5 material containing sufficient moisture to allow compaction to 90% maximum dry density. Soil Type S2 shall meet requirements of Type S5. No additional payment will be made for such additional excavation or backfill.

I. Excavate trenches to provide the design grade of the facility, or as directed by the Engineer.

J. Stockpile excavated material to be returned to trench adjacent thereto in location which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove from site all unsuitable or excess material not to be used.

K. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw.

L. Remove excess soil not used as backfill from the work site. Obtain a disposal site off of the Owner's property and legally dispose of said excess material, all at no additional cost to the Owner.

M. If water is encountered during excavations, provide all dewatering measures necessary to construct improvements shown.

N. Contractor shall make all provisions necessary, including but not limited to, shoring or sloping back trench walls as required to address sandy soils. The cost of these provisions shall be included in the lump sum amount bid for this work and no separate payment will be made therefore.

3.3 PROTECTION OF EXCAVATIONS

A. Provide all shoring and bracing as required and those codified in local, state and federal safety regulations.

B. Prevent water, caving or sloughing ground from entering excavations.

C. Maintain excavations free of water.

3.4 BACKFILLING

A. Provide type S2 or S5 pipe bedding as required by Plans and compact to 90% maximum dry density. Soil Type S2 shall meet requirements of Type S5.

B. After installation of pipes and appurtenances and placement of pipe bedding material, backfill trenches and excavations to finished grade, or subgrade in areas to receive surface improvements

C. Backfill trenches to a minimum of 12 inches above the pipe and any couplings with Type S2 or S5 material, containing sufficient moisture to allow compaction to 90% maximum dry density. Soil Type S2 shall meet requirements of Type S5.

D. Backfill trenches above pipe bedding material and to within 24 inches of finish subgrade with Type S1, S2, S4, or S5 soils, except that that top 12 inches shall be type S2, S3, S4, or S5 soils.

E. Employ a placement method that does not disturb or damage existing or proposed pipes or other Utilities or Improvements.

F. Place and compact all soil backfill in continuous layers not exceeding 8 inches in loose uncompacted thickness, moisture condition to at least 2% above optimum moisture content.

G. Maintain optimum moisture content of fill materials to attain required compaction.

H. Backfill final 12-inch thickness to finish subgrade in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement, with Type S2, S4, or S5 soils.

I. Backfill final 12-inch thickness to finish subgrade in areas to receive sod, other vegetation, or bare soil, with Type S2 or S3 soils.

J. Compact backfill below the top 12-inches to 90% maximum dry density.

K. In areas to receive buildings, structures, or concrete flatwork, compact the top 12-inches to 90% maximum dry density.

L. In areas to receive asphalt concrete pavement or concrete pavement subject to vehicular traffic, compact the top 12-inches to 95% maximum dry density.

M. In planting areas, compact the top 12-inches to 85% maximum dry density.

3.5 TOLERANCES

A. Top Surface of Backfill under Paved or Concrete Areas: Plus or minus 0.02 feet from required elevations.

B. Top Surface of General Backfilling: As required for finish surface to match adjacent improvements or ground.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of General Conditions and/or Division 1.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, recompact, and retest. Retests required due to failure of initial tests shall be paid for by the Contractor.

3.7 PROGRESS AND PROSECUTION

A. Backfill any excavation opened in any day on that same day.

END OF SECTION

SECTION 321126
AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to install aggregate base surfacing as indicated by the Contract Documents.

B. RELATED SECTIONS
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 312000 – Earthwork: Excavation, Filling, and Grading.
   3. Section 312333 – Trench Excavation and Backfill.
   4. Section 321216 – Soil Sterilization.
   5. Section 321217 – Asphalt Paving.
   6. Section 321313 – Site Concrete Improvements.

1.3 REFERENCES

A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials

1.4 QUALITY ASSURANCE

A. Provide and install in accordance with SSCDOT.

1.5 SUBMITTALS

A. Submit data sheets from supplier to document compliance with SSCDOT requirements.

B. Certificates of compliance for material.

C. Load tags for delivered material.

1.6 COORDINATION

A. Coordinate with other work, including subgrade preparation and soil sterilization.

B. Coordinate installation schedule with Owner's use of the premises and with other contractors working at the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate Base: Unless specified otherwise on Plans, Class 2, 3/4 Inch Maximum per Section 26 of SSCDOT.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify quantities required.

B. Verify that subgrade has been placed and compacted per Contract Documents

C. Verify gradients and elevations of subgrade are correct.

3.2 INSTALLATION OF AGGREGATE BASE COURSE

A. Install in conformance with SSCDOT Section 26, Aggregate Bases.

B. Thickness - As shown on construction drawings.

C. Spreading and Compacting - In accordance with Section 26, SSCDOT. Base course shall be moisture conditioned to within 2% of optimum moisture, placed in uncompacted layers not exceeding eight (8) inches in thickness, and compacted as specified, based on ASTM Test Method D1557. The relative compaction of each layer of compacted base material shall be not less than 95 percent.

D. The completed surface shall be thoroughly compacted, free from ruts, depressions, and irregularities, true to grade and cross-section.

E. Lines and grades for the installation of aggregate base shall be set by a California licensed Land Surveyor or Civil Engineer, at Contractor's expense.

3.3 TOLERANCES

A. Compacted thickness of aggregate base: Not less than the thickness specified on the Plans.

B. Finished Surface: Within 0.02 foot of planned grade per Section 26, SSCDOT. No more than 50% of the finish surface shall be above or below the specified grade for aggregate base.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed by the Owner's inspector, under provisions of Division 01.

3.5 PROTECTION

A. Immediately after placement and compaction, protect surface from mechanical injury.

B. Protect completed surface until surfacing layers are in place.

END OF SECTION

SECTION 321216
SOIL STERILIZATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work specified in this section.

1.2 SECTION INCLUDES

A. This Section includes the following:
   1. Furnish and install soil sterilant under all asphalt paving.

B. RELATED SECTIONS
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 312000 – Earthwork: Excavation, Filling, and Grading
   3. Section 312333 – Trench Excavation and Backfill
   4. Section 321126 – Aggregate Base Course
   5. Section 321217 – Asphalt Paving

1.3 STANDARDS

A. In accordance with the following:

CCR-T21	California Code of Regulations, Title 21 Public Works.
CBC	California Building Code, California Code of Regulations, Title 24, Part 2, CCR-T24.
USDA	United States Department of Agriculture.
EPA	Environmental Protection Agency.
CV	City of Visalia

All applicable Environmental Regulations and Standards.

1.4 QUALITY ASSURANCE

A. Provide licensed operator to apply soil sterilant.

B. All products shall comply with the current EPA laws at time of application. Should the products listed become unavailable because of changes in the law, submit substitute products for review by the Owner.

1.5 SUBMITTALS

A. Submit in accordance with Specification Section SUBMITTAL PROCEDURES.

B. Certificates of application.

C. Certificates of compliance for material.

1.6 COORDINATION

A. Coordinate with other work, including subgrade preparation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Soil Sterilant: Bayer Oust XP, weed and grass preventer, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that site is ready for application.

3.2 PREPARATION

A. Identify installation locations.

B. Employ equipment and methods appropriate to the work site.

3.3 APPLICATION

A. Thoroughly water soak surface to be treated. Avoid excessive water runoff.

B. Apply sterilant solution over surface to receive pavement or surfacing prior to the start of pavement or surfacing installation.

C. Apply in spray form, at rate as allowable by State of California and the manufacturer's recommended application rate.

D. Take all precautions to limit soil sterilant solution to areas immediately under proposed pavement or surfacing. Use shields as necessary, and do not apply under windy conditions.

END OF SECTION

SECTION 321217
ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install all pavement materials, accessories and other related items as required by the Contract Documents.

B. RELATED SECTIONS
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 312200 - Earthwork: Excavation, Filling, and Grading
   3. Section 312333 - Trench Excavation and Backfill
   4. Section 321126 - Aggregate Base Course
   5. Section 321216 - Soil Sterilization

1.3 REFERENCES

A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with SSCDOT.

B. Mixing Plant: Conform to SSCDOT.

C. Installation Criteria: Asphalt concrete shall show no evidence of cracking, uneven settlement, improper drainage, or untoward junctions with adjoining or existing surfaces. Work displaying such conditions shall be corrected under the Contractor’s guarantee of all work.

1.5 SUBMITTALS

A. Submit under provisions of Division 01.

B. Mix design

C. Certificates of compliance for material.

D. Load tags for delivered material.

1.6 COORDINATION

A. Coordinate with other work, including subgrade preparation, aggregate base placement and soil sterilization.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt-concrete when atmosphere temperature is less than 50 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint Binder: In accordance with SSCDOT Section 94, Asphaltic Emulsions.

B. Asphalt-Concrete: Type A in accordance with Section 39, SSCDOT, ½ inch or ¾ inch maximum aggregate (medium) as indicated on the Plans. Use asphalt binder performance grade PG 64-10.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify quantities required. New asphalt-concrete paving is required at all locations shown on the plans, and where existing asphalt-concrete paving to remain is removed or damaged by the Project excavation or related work.

B. Verify that subgrade or base material has been compacted to required relative compaction and is dry.

C. Verify gradients and elevations of base are correct.

D. Verify that subgrade or base material has been sterilized per Section 32 12 16 SOIL STERILIZATION.

3.2 AGGREGATE BASE

A. Where shown on the construction plans, place and compact aggregate base course per Section 321126 AGGREGATE BASE COURSE.

B. Where shown on the construction plans, place asphalt on compacted earth subgrade per Section 312000 EARTHWORK: EXCAVATION, FILLING AND GRADING and Section 312300 TRENCH EXCAVATION AND BACKFILL.

C. A soil sterilant shall be applied over the entire area which is to be paved in accordance with Section 311216 SOIL STERILIZATION

3.3 PREPARATION – PAINT BINDER

A. Apply paint binder to existing asphalt-concrete or concrete surfaces which will be in contact with asphalt-concrete surfacing.

B. Rate of application for all surfaces against which asphalt concrete is to be placed shall be no less than 0.02 and no more than 0.05 gallons per square yard. All vertical concrete surfaces which will be in contact with asphalt concrete surfacing and all areas now in place which will be covered with new surfacing materials and feathering operations shall be coated with a paint binder applied at the rate of 0.05 gallons per square yard.

3.4 INSTALLATION OF ASPHALTIC-CONCRETE

A. Install in conformance with SSCDOT Section 39, Asphalt-Concrete.

B. Thickness - As shown on construction plans. Where thickness exceeds 3 inches, place in no less than 2 layers with top layer no thicker than one inch. Asphaltic concrete shall be laid to the thickness designated on the Plans. The plan thickness is to be considered as a minimum thickness. The Contractor shall lay the asphaltic concrete to a depth required to insure that, after compaction, the in place compacted thickness is equal to or greater than the specified plan thickness.

C. The Contractor shall provide to the Engineer the truck delivery weight tags for the asphaltic concrete material. The quantity delivered shall be equal to or greater than the calculated in place quantity based on the specified thickness and area to be paved as designated on the construction plans and based on a unit density of the asphaltic concrete of 141 pounds per cubic feet.

D. Asphalt type: PG 64-10

E. Compaction Equipment - In accordance with Section 39, SSCDOT. At small difficult areas, equipment may be altered as approved by Engineer.

F. The completed surface shall be thoroughly compacted, free from ruts, depressions, and irregularities and to be true to grade and cross-section.

3.5 TOLERANCES –GENERAL

A. Finished Surface: within 0.02 foot of planned grade.

B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.

C. Scheduled Compacted Thickness: Not less than specified.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01.

B. Pavement shall comply with the following:
   1. Water shall not be able to accumulate at any point and the surface shall be free to drain to drainage inlets or gutters.
   2. The paving contractor shall water flood the surface with the use of a water truck. If, after 30 minutes on a 70 degree F day, “bird baths” are evident in a depth more than 0.01 foot, the paving contractor and the Owner’s representative will determine the best method of correction.
   3. A 10 foot straightedge shall be used to check for high spots and ridges. High spots and ridges out of compliance shall be reduced by a remedy determined by the paving contractor and the Owner’s representative.

C. Should a section of the work be not acceptable on the basis of inadequate compaction and/or the mixture becomes loose and broken, mixed with dirt, out of tolerance, or in any other way defective, it shall be repaired or removed and replaced with fresh mixture and immediately compacted to conform to the surrounding area to the satisfaction of the Owner.

3.7 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury.

B. Protect sealed surface until it is cured.

END OF SECTION

SECTION 321313
SITE CONCRETE IMPROVEMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:
   1. All material, labor, equipment and services necessary to completely install exterior Portland cement flatwork, cast-in-place concrete, and architectural flatwork concrete, accessories and other related items, slabs, ramps and sidewalks and walkways, curb and gutter, mowstrips, and other miscellaneous concrete items of the form and dimensions shown on the plans and necessary to complete the project, and in accordance with the requirements of the Standard Specifications as modified and supplemented by these Special Provisions

B. RELATED SECTIONS:
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 312000 - Earthwork: Excavation, Filling, and Grading
   3. Section 321126 - Aggregate Base Course
   4. Section 321315 - Concrete Reinforcement

1.3 REFERENCES

A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.

B. ACI standards, including but not limited to #304, 305, 306, 308, 309 and 347.

C. ASTM standards, including but not limited to #C-33, C-39, C-94, C-136, C-143, C-150, and C-309.

1.4 SUBMITTALS

A. Submit under provisions of Specification Section SUBMITTALS.
   1. Certificates of compliance for materials and mix designs.
   2. Load tags for delivered material.
   3. Strength testing as required by the approving agency.
   4. Integral color sample, where applicable.
   5. Application instructions for the architectural finish materials.

6. Accessories and manufacturer's installation specifications.

1.5 QUALITY ASSURANCE

A. Furnish concrete materials conforming with SSCDOT.

B. Perform work in accordance with SSCDOT, unless noted otherwise herein.

PART 2 - PRODUCTS

2.1 MIXES

A. Mix Design and Proportions in accordance with SSCDOT:
   1. Mix designs with Fly Ash content no greater than 15 percent of the total weight of cementitious materials shall be proportioned by SSCDOT.
   2. Provide a maximum of 4 percent air entrainment, unless noted otherwise.
   3. Owners Testing laboratory shall review all mix designs before submittal.
   4. All concrete shall have the following minimum compressive strengths in accordance with ACI 318 and SSCDOT at 28 days and shall be proportioned within the following limits:
      a. Site Concrete: Use for exterior concrete slabs on grade including, but not limited to sidewalks, curbs, gutters, mow strips, utility appurtenances and miscellaneous site improvements.
         1) Strength: 3,000 psi at 28 days
         2) Maximum Aggregate Size: 1-inch
         3) Cement Type: Type II
         4) Cement Content: 5.5 sacks/yd minimum
         5) Max Water/Cement Ratio: Per SSCDOT
         6) Admixture Per SSCDOT

      b. Structures & Vehicular Concrete Paving: Use for site structures and exterior slabs on grade subject to vehicle traffic.
         1) Strength: 4,000 psi at 28 days
         2) Maximum Aggregate Size: 1-inch
         3) Cement Type: Type II
         4) Cement Content: 6.5 sacks/yd minimum
         5) Max Water/Cement Ratio: Per SSCDOT
         6) Admixture: Per SSCDOT

      c. Slurry Backfill: Use for backfill of over-excavated trenches, encasement of all penetration, and site utility piping.
         1) Maximum Aggregate Size: 3/8-inch
         2) Cement Type: Type II
         3) Cement Content: 2.0 sacks/yd minimum

B. Reinforcement shall comply with relevant portions of Division 32 Specification Section CONCRETE REINFORCEMENT.

PART 3 - EXECUTION

3.1 PREPARATION

A. Subgrade shall conform to the requirements of Division 31 Specification Section EARTHWORK: EXCAVATION, FILLING AND GRADING. The District may elect to verify compacted subgrade elevations by measurement made from adjacent existing improvements or by a template supported by forms.

3.2 GENERAL CONCRETE

A. Concrete placement shall conform to the applicable requirements of Standard Specification Sections 51 and 90. Concrete shall not be placed when the air temperature in the shade at the project site exceeds 95º F or is below 45º F, or when the temperature of the concrete exceeds 85º F.

B. After the concrete has been placed, it shall be struck off to proper section and compacted with a grid of parallel metal bars until a layer of mortar not less than 3/8 inch thick has been brought to the surface. All exposed concrete surfaces shall receive a medium broom finish applied transversely to the line of pedestrian traffic or to the longest dimension of the concrete, as applicable.

C. General concrete surfaces shall be cured by the curing compound method and shall be protected in accordance with the provisions of Subsections 90-1 and 90-2 of the Standard Specifications.

3.3 PROTECTION OF CONCRETE

A. The Contractor shall be responsible for the condition of all concrete work until such time as all work has been completed and is accepted by the District. The Contractor shall limit vehicular travel across concrete until such time as the concrete has achieved strength sufficient that it can support traffic without damage. In no case, however, will vehicles be allowed to travel across new concrete improvements until seven calendar days have passed since the concrete was placed.

3.4 CONCRETE JOINTS

A. Expansion joints and weakened plane joints shall be constructed at the locations shown on the plans or as directed by the Engineer. Where joint locations are not specified on the plans, expansion joints shall be constructed at maximum intervals of 30 feet, and weakened plane joints shall be constructed at maximum intervals of 10 feet.

B. Expansion joints shall be considered as weakened plane joints for the purpose of spacing weakened plane joints. Expansion joints shall be tooled with a 1/4 inch maximum radius edger, and shall be filled with 3/8 inch pre-formed expansion joint filler.

3.5 CONCRETE FINISHES

A. Where concrete is being installed adjacent to or near existing concrete improvements, match the finish of similar concrete surfaces (i.e. new sidewalks shall match existing sidewalks, new curbs shall match existing curbs, etc.).

B. Sidewalks and Mowstrips: Medium sweat finish or medium broom finish perpendicular to the direction of travel.

C. Curbs: Trowel smooth and finish with a light brush.

D. Gutters: Medium broom finish parallel with curb or direction of flow.

E. Drive approaches and wheelchair ramps: medium broom finish, perpendicular to the direction of travel.

3.6 INSTALLATION OF ACCESSORIES

A. Strictly comply with manufacturer's instructions and recommendations and approved details. Securely anchor work to substrate.

3.7 REPAIR AND CLEAN-UP

A. Contractor shall legally remove all trash, debris, containers and excess materials from the site on a periodic basis, and shall keep the work broom clean until Owner’s acceptance.

B. The Contractor shall be held responsible for the repair and/or replacement of new or existing improvements damaged as a result of this work to the satisfaction of the Owner.

C. The Contractor shall provide roll-off bins for wash-out of ready mix concrete trucks and pumpers. Do not allow concrete debris or cement water onto soils scheduled for landscape planting.

END OF SECTION

SECTION 321315
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:
   1. Deformed reinforcing bars for site concrete improvements.

B. RELATED SECTIONS
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 321313 - Site Concrete Improvements

1.3 SUBMITTALS

A. Submit in accordance with Specification Section SUBMITTALS and the Contract General Conditions.
   1. Mill test certificates identifying chemical and physical analysis of each load of reinforcing steel delivered. If mill test reports are not available and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove yield strength and bending.
   2. Drawings and placing diagrams for each grade slab including dowels and corner bars.
   3. On the placing diagrams, show all openings for pipelines and architectural features. Include additional reinforcing at openings and corner bar arrangements at intersecting beams, walls, and footings.
   4. Coordinate placing diagrams with the concrete placing schedule.

1.4 PRODUCT DELIVERY

A. Deliver reinforcement to project site in bundles marked with tags indicating bar size and length.

B. Store on wooden supports above ground surface.

PART 2 - PRODUCTS

2.1 BARS

A. Bars shall be deformed billet steel conforming to ASTM A 615, Grade 60. Mixing of steel grades will not be allowed.

2.2 BAR SUPPORTS

A. Bar support shall be concrete or metal chairs, spacers or hangers. Reinforcing bars shall not be supported by forms.

2.3 TIE WIRE

A. Tie wire shall be annealed steel wire of not less than 16-gauge.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Position reinforcement in accordance with the drawings, secure with wire ties or suitable clips at all intersections, and support by an adequate number of concrete or metal chairs, spacers, or metal hangers such that reinforcing bars do not sag more than one quarter of an inch (1/4”) between supports. Do not place reinforcement or supports in contact with the forms. Bend tie wires away from the forms in order to provide the specified concrete coverage. To secure reinforcement in position, the Contractor may elect to locate bars additional to those shown on the drawings, but at no additional cost to the Owner.

B. Set reinforcing dowels and anchor bolts in place prior to placing concrete. Do not press them into the concrete after the concrete has been placed.

3.2 SPLICES

A. Splice bars only at locations shown on the drawings. Where splices are not detailed, lap bars 72 bar diameters.

3.3 CLEANING

A. Remove dirt, form oil, excessive rust, cement coating from previous pours, and foreign matter that will reduce bond with concrete.

3.4 PROTECTION DURING CONCRETING

A. Keep reinforcing steel in proper position during concrete placement.

END OF SECTION

SECTION 321373

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Joint-sealant backer materials.
3. Primers.

B. Related Requirements:

1. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of joint sealant and accessory.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED JOINT SEALANTS

A. Cold Applied Joint Sealants: Provide one of the following:

1. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

a. Available Product: W.R. Meadows, Inc.; Pourthane SL.

1) Subject to compliance with requirements, provide product indicated or a comparable product subject to Architect’s approval.

2. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.

a. Available Product: Pecora Corporation; Urexpan NR-200 or DynaFlex.

1) Subject to compliance with requirements, provide product indicated or a comparable product subject to Architect's approval.

B. Joint-Sealant Application: Joints within concrete paving, locations as follows:

1. Expansion and isolation joints in concrete paving.
2. Contraction joints in concrete paving.
3. Other joints as indicated.

C. Joint-Sealant Color: As selected by Architect from Manufacturer's full range.

D. Joint-Sealant Color: As selected by Architect from Manufacturer's full range.

2.3 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods: ASTM D 5249, Type 1 or Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
4. Fill joints to depths shown, or if not shown, as recommended by sealant manufacturer, and equal to 75 percent of joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 321723
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:
   1. Furnish and install paint markings for parking stall, traffic delineation, wording, ADA markings, and hatching area on concrete and asphalt concrete pavement.

B. RELATED SECTIONS
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 32 12 17 - Asphalt Paving.
   3. Section 32 13 13 - Site Concrete Improvements.

1.3 REFERENCES

A. SSCDOT Standard Specifications, California Department of Transportation (Caltrans), latest edition, except for references to methods of payment and to furnishing of materials by State.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Certificates of compliance for materials.

1.5 COORDINATION

A. Coordinate work with other work, including associated traffic signing.

B. Commence striping or marking of asphalt concrete no sooner than 7 days following any sealing of the asphalt concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint: Quick drying, high visibility water soluble acrylic striping paint; Stripe Master, Wikel Mfg. Company, or similar by Sherwin Williams, J.E. Bauer, PPG, International Coatings, or approved equal.

B. Paint shall be of color indicated on the construction plans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that site is ready for application.

3.2 PREPARATION

A. Identify installation locations. Place parking stall striping, traffic marking, wording, disabled symbol and access striping at locations, as shown on construction plans.

B. Thoroughly clean all surfaces to be painted.

C. Employ equipment and methods appropriate to the work site.

D. Provide vehicular and traffic controls per Division 1.

3.3 INSTALLATION

A. Apply paint striping and marking as indicated on the plans.

B. Apply paint uniformly, straight and true, with equipment designed for traffic striping and marking applications.

C. Apply paint striping and marking per Section 84 of SSCDOT, except supply paint conforming to 2.1 A. of this specification.

D. Apply a minimum of 2 separate coats of paint at all striping and marking locations, including asphalt concrete and concrete surfaces.

E. Paint international symbol of accessibility at the location as shown on the plans.

F. Paint accessible access area striping at the location as shown on the plans.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Division 1.

END OF SECTION

SECTION 322852
PARKING LOT FURNITURE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:
   1. Furnish and install signs, posts and concrete wheelstops.

B. RELATED SECTIONS
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 32 12 17 - Asphalt Paving
   3. Section 32 13 13 - Site Concrete Improvements

1.3 REFERENCES

A. SSCDOT – Standard Specifications, California Department of Transportation (Caltrans), latest edition, except for references to methods of payment.

B. CBC – California Building Code, latest edition.

1.4 SUBMITTALS

A. Submit under provisions of Specification Section - SUBMITTAL PROCEDURES.

1.5 COORDINATION

A. Coordinate work with Owner’s personnel.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Signs: As per detail drawing.

B. ADA Accessible Signs: As per detail drawing.

C. Sign Posts: 2 inch diameter galvanized iron pipe, A 120, Schedule 40, unless otherwise shown on drawing.

D. Concrete for Sign Footings: Specification Section – SITE CONCRETE IMPROVEMENTS

E. Wheelstop: 3 or 4 feet long pre-cast concrete per detail drawing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing and proposed site conditions.

3.2 PREPARATION

A. Identify installation locations.

B. Locate, identify, and protect existing above and below grade utilities from damage.

C. Employ equipment and methods appropriate to the work site.

3.3 INSTALLATION

A. Install all sign posts straight and plumb in concrete footings as shown on plans.

B. Secure all signs to posts with vandal resistant galvanized hardware furnished by the Contractor.

C. Orient direction of all signs as indicated on the plans.

D. Install concrete wheelstops at locations shown on drawings. Anchor each wheelstop with two deformed reinforcing bars driven into the asphalt concrete pavement per detail drawing.

3.4 FIELD QUALITY CONTROL

A. Field inspection will be performed under Division 01.

END OF SECTION

SECTION 323113

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences and associated fence framing.
2. Swinging service gates.
3. Privacy slats, where indicated on drawings.

B. Related Sections:

1. Division 03 Section “Cast-In-Place Concrete” for concrete for setting fence posts.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, gate hardware, and finishes for chain-link fences and gates.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Accessible Pedestrian Gates: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility

Guidelines, ICC/ANSI A117.1, and the accessibility requirements of Chapter 11B of the California Building Code.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide chain link fence fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to “CLFMI Product Manual” and requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Wire diameter: 0.148 inches (9 gage).
3. Mesh Size: 2 inches.
4. Zinc-Coating: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving.
5. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 or ASTM F1083 based on the following:

1. Fence Height: As indicated on Drawings.
2. Heavy industrial strength round steel pipe, material Group IA, schedule 40, galvanized; pipe coated inside and outside by hot-dipped method, 1.8 oz. per square foot of outside and inside surfaces; provide members with minimum dimensions and wall thickness according to ASTM F 1083 based on the following:

    a. Line Posts:

        1) Fence height to 6 feet: 1.9 inches outside diameter, 2.72 plf.
        2) Fence height over 6 feet to 8 feet: 2.375 inches outside diameter, 3.65 plf.

    b. End, Corner and Pull Posts:

        1) Fence height to 6 feet: 2.375 inches outside diameter, 3.65 plf.
        2) Fence height over 6 feet to 8 feet: 2.875 inches outside diameter, 5.79 plf.

    c. Gate Posts: Posts for individual gate leaf widths as follows:

        1) Gate leaf width to 6 feet: 2.875 inches outside diameter, 5.79 plf.
        2) Gate leaf width over 6 feet to 12 feet: 4.0 inch outside diameter, 9.11 plf.

    d. Horizontal and Brace Rails: 1.66 inches outside diameter, 2.27 plf.

2.4 TENSION WIRE

A. Tension Wire: 0.177-inch diameter, marcelled steel tension wire complying with ASTM A 817 and ASTM A 824; Type II, zinc coated (galvanized), Class 4, not less than 1.2 oz./sq. ft. of uncoated wire surface.

2.5 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and swing gate types.

1. Gate Height: Match fence height.
2. Gate Leaf Width: As indicated on Drawings.

a. Pedestrian gates shall provide not less than 32 inches in clear width with the gate in a 90 degree open position; gate leaf width shall not exceed 48 inches.
b. Service Gates: Width as indicated on Drawings.
c. Fire department vehicle access gates shall provide not less than 20 feet in clear width with the gates in a 90 degree open position.

B. Gate Framing: Steel pipe matching fence framing and as follows:

1. Gate leaf width up to 6 feet: Perimeter and intermediate framing of 1.90 inches outside diameter, 2.72 plf.
2. Gate leaf width over 6 feet to 12 feet: Perimeter framing of 2.375 inches outside diameter, 3.65 plf., and intermediate framing and bracing of 1.90 inches outside diameter, 2.72 plf.

C. Gate Construction:

1. Joints and Connections: Weld all joints and connections.
2. Bracing: Provide adjustable truss rod bracing for all gates and between intermediate framing members for gate leaves over 8 feet in width.
3. Intermediate Framing: Provide intermediate vertical framing for gates exceeding 8 feet in width; equally space intermediate framing and space not more than 8 feet on center; weld connections.
4. Kick Plates for Accessible Pedestrian Gates: Provide 1/8 inch thick by 10 inch high galvanized steel plates at the bottom of each side of gates to provide a smooth and unobstructed surface for persons in a wheel chair. Kick plates shall be without sharp edges or corners. Plates shall not interfere with the ability to adjust truss rod bracing.

D. Gate Hardware:

1. Hinges: 180-degree swing in direction indicated on Drawings.
2. Latches permitting operation from both sides of gate with provision for padlocking from both sides of gate.
3. Paired Gates: The inactive leaf of paired gates shall be provided with a drop rod and be capable of being locked with a padlock.
4. Gate Stops: Provide gates stops for each leaf of paired gates.

5. Gate Keepers: Provide gate keepers for each gate leaf 5 feet or more in width.

2.6 FITTINGS

A. Fittings, General: Comply with ASTM F 626.

B. Post Caps: Caps shall be weatherproof to prevent moisture intrusion into posts. Provide line post caps with loop to receive top rail; provide post cap for each post.

C. Rail and Brace Ends: Designed to provide secure connection of top rails to terminal post and brace or other rails to terminal and intermediate posts; provide for each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel for posts up to 4 inches in outside diameter.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment; 5/16 inch minimum rod diameter.

H. Tie-Wire: Standard round wire ties for attaching chain-link fabric to posts, rails, and frames; hot-dip galvanized steel, 0.148-inch (9 gage) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Hog Rings: Round wire ties for attaching chain-link fabric to bottom tension wire; 0.12-inch diameter of same material and finish as fabric wire.

J. Finish: Metallic coating for pressed steel or cast iron fittings, not less than 1.2 oz. /sq. ft. zinc.

2.7 PRIVACY SLATS (Where indicated on Drawings)

A. Fiber-Glass-Reinforced Plastic Slats: UV-light-stabilized fiber-glass-reinforced plastic, not less than 0.06 inch thick, sized to fit mesh specified for direction indicated.

B. Tubular Polyethylene Slats: Minimum 0.023-inch thick tubular polyethylene, manufactured for chain-link fences from virgin polyethylene with UV inhibitor, sized to fit mesh specified for direction indicated.

C. Color: As indicated on Drawings or as selected by Architect from manufacturer's full range.

2.8 SETTING MATERIALS

A. Cementitious Material: Portland cement, ASTM C 150, Type II, gray.

B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information. Proportion normal-weight concrete mixture as indicated below for strength, slump, water/cement ratio, and maximum aggregate size.

1. Strength: 3000 psi at 28 days.
2. Aggregate Size: 1-1/2 inch maximum.
3. Slump: 4 inches.
4. Water Cement Ratio: 0.53 Maximum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 200 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.

1. Install fencing at locations indicated on Drawings; for fencing located at property lines, install fencing inside property line.

3.4 FENCE FRAMING INSTALLATION

A. Post Excavation and Footings: Drill or hand-excavate holes for posts to diameters, depths, and spacings indicated on Drawings in firm undisturbed soil.

1. If footing diameters and depths are not indicated on Drawings, footings shall be as follows:

    a. Tops of footings shall be established as 4 inches below finish grade.
    b. Fences to 6 Feet in Height:

        1) Line Posts: 10 inches diameter by 30 inches deep.
        2) End, Corner, and Pull Posts: 10 inches diameter by 36 inches deep.
        3) Gate Posts, Gate leaf to 6 Feet Wide: 12 inches diameter by 42 inches deep.
        4) Gate Posts, Gate leaf over 6 Feet to 12 Feet Wide: 16 inches diameter by 48 inches deep.

B. Post Setting: Set posts with concrete footings at indicated spacing.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Comply with the following for posts in paved areas installed prior to paving:

        1) Posts in Concrete Paved Areas, Curbs, and Mow Strips: Coordinate top of paving elevation and pour concrete fill to approximately 6 inches below finish grade.
        2) Posts in Asphalt Concrete Paved areas: Concrete fill to be flush with adjacent paving and crowned to shed water away from posts. Coordinate top of paving elevation and form top 6 inches of footing with round concrete form of diameter matching post footing; pour concrete fill prior to paving operations.

    b. Posts in Unpaved Areas: Concrete fill to be 2 inches above finish grade and crowned to shed water away from posts. Coordinate finish grade elevation and form top 6 inches of footing with round concrete form of diameter matching post footing.

C. Terminal Posts: Install terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

D. Line Posts: Space line posts uniformly at 10 feet o.c. unless otherwise indicated.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric on fences with top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. Intermediate and Bottom Rails: Where indicated or required, install and secure to posts with fittings.

H. Bottom Tension Wire: Install according to ASTM F 567 extended along and within 6 inches of bottom of fabric maintaining plumb position and alignment of fencing. Pull wire taut, without sags; install tension wire before stretching fabric; tie to each post with not less than same diameter and type of wire.

3.5 CHAIN-LINK FABRIC INSTALLATION (Where indicated on drawings)

A. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

B. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

1. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

C. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing. Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

D. Fasten fabric to bottom tension wire with 0.120 inch diameter hog rings spaced a maximum of 24 inches o.c.

E. Privacy Slats: Install slats in vertical direction, securely lock in place.

3.6 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION

SECTION 323119
DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Decorative metal fences and gates (shop fabricated) per site location.

B. Related Requirements:

1. Division 03 Section “Cast-in-Place Concrete” for concrete for setting fence posts.
2. Division 05 Section "Metal Fabrications" for metal fabrications not included in this section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials.

B. Shop Drawings: Include plans, elevations, component details, and attachments to other work. Indicate materials and profiles of each metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing decorative metal fencing and gates similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Installer Qualifications: Fabricator of products.

C. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store decorative metal fencing and gates in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal fencing and gates by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements for Gates and Hardware: Pedestrian gates and hardware shall comply with accessibility requirements of 2010 ADA Standards for Accessible Design and the 2022 California Building Code, Chapters 10 and 11B.

1. Gates shall be capable of opening a minimum of 90 degrees.
2. Gates in the open position shall provide a clear opening width of not less than 32 inches.
3. The bottom 10 inches of the push side of required egress man-gates shall have a smooth uninterrupted surface that allows the door to be opened by a wheel chair footrest without creating a trap or hazardous condition.
4. The effort to open gates shall not exceed a 5 pound force applied perpendicular to the face of the gate.
5. Gates shall be openable from the secure side (inside) without the use of a key or special knowledge or effort. Operating hardware shall not require pinching or grasping to operate hardware.

    a. Gates may be designed for key operation from either or both sides when gates are not required egress gates as determined by the Architect and the Division of the State Architect.

2.2 STEEL AND IRON MATERIALS

A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Tubing: ASTM A 500/A 500M (cold formed).

C. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M unless otherwise indicated.

F. Steel Sheet, Cold Rolled: ASTM A 1008/A 1008M, either commercial steel or structural steel, exposed.

2.3 FASTENERS

A. Fastener Materials: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating or Type 304 stainless steel.

B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

C. Post-Installed Anchors: Mechanical fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.5 SETTING MATERIALS

A. Cementitious Material: Portland cement, ASTM C 150, Type II, gray.

B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information. Proportion normal-weight concrete mixture as indicated below for strength, slump, water/cement ratio, and maximum aggregate size.

1. Strength: 3000 psi at 28 days.
2. Aggregate Size: 1-1/2 inch maximum.
3. Slump: 4 inches.
4. Water Cement Ratio: 0.53 Maximum.

2.6 FABRICATION, GENERAL

A. Fabricate fence panels in sections to prevent the need for field welding or cutting. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

1. Components of fabricated items shall not be finished until after fabrication.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

D. Provide necessary brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.

E. Connect members with full-penetration welds unless otherwise indicated. Use welding method that is appropriate for metal and finish indicated and that develops full strength of members joined. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

2.7 DECORATIVE METAL FENCING

A. General: Fabricate decorative metal fencing from steel bars and shapes of sizes and profiles indicated.

1. Fabricate fence panels in sections to facilitate galvanizing, transportation to the Project Site, and installation.

B. Fence Height: As indicated on Drawings.

C. Posts, Rails, and Pickets: Square steel tube sections complying with ASTM A-500 with hot dipped galvanized exterior zinc coating and as follows:

1. Posts: Posts having a minimum yield strength of 45,000 psi and a minimum size as follows:

    a. Posts for Fences: Size as indicated on Drawings, not less than 2.5 inches square x 1/4 inch thickness.

        1) Spacing: As indicated on Drawing, not more than Nominal 8 feet on center maximum; posts shall be equally spaced on a standard module.

    b. Posts for Swing Gates: Size as indicated on Drawings, not less than the following:

        1) Gates to 48 inches Wide: 4 inches square x 1/4 inch wall thickness.
        2) Gates over 48 inches Wide to 96 inches Wide: 6 inches square x 1/4 inch thickness.
        3) Gates over 96 inches wide to 144 inches Wide: 6 inches square x 3/8 inch thickness.

2. Horizontal Rails: Size as indicated on Drawings, not less than 1.5 inches square x 11 gage.

3. Pickets: Size as indicated on Drawings, not less than 3/4 inch square x 11 gage (0.120 inch).

    a. Spacing: 4 inches on center nominal; pickets shall be spaced such that a 4 inch diameter sphere shall not be capable of passing through the opening.

D. Perforated Mesh Panels: Pre-galvanized, 3/32 inch round on 3/16 inch staggered centers, 23% open area, 22 gage.

1. Basis of Design: Diamond Perforated Metals. 7300 W. Sunnyview Ave., Visalia CA 93291.
2. Or Approved Equal

E. Finish: Galvanize and powder coat after fabrication.

2.8 SWING GATES

A. General: Fabricate decorative metal swing gates from steel bars and shapes of sizes and profiles indicated in Drawings, match characteristics of fence design.

1. Pedestrian gates shall comply with accessibility and hardware requirements indicated in Part 2 “Performance Requirements” Article.

B. Gate Height: Match adjacent fence panels.

C. Gate Width: As indicated on Drawings; 32 inches minimum clear width when gate is in a 90 degree open position.

D. Gate Framing: Hollow tubular steel sections of size, wall thickness, and spacing as indicated on Drawings, not less than 1.5 inches x 1.5 inches x 11 gauge (0.120 inch) minimum size).

E. Rails: Match fence rails.

F. Pickets: Match fence pickets.

G. Hinges: As indicated on Drawings; hinges to be sized for not less than twice the weight of the gate and allow the gate to open 180 degrees.

H. Operating Hardware: Gates shall be prepared to receive cane bolts, cylinder lock, mortise lock, padlock, or exit device as indicated on the drawings.

I. Perforated Mesh Panels: Match Fence Panels

J. Finish: Galvanize and powder coat after fabrication.

2.9 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M. Galvanize items after fabrication.

1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.
2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. Powder-Coat Finish for Galvanized Metal: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 2 mils.
4. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal fences and gates.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Provide anchorage devices and fasteners where needed to secure decorative metal fencing to in-place construction.

B. Set posts accurately in location, alignment, and elevation; measured from established lines and levels.

1. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil. Footings shall have a diameter not less than 4 times the width of posts and shall extend 6 inches below the bottom of the post.
2. Post Setting: Set posts in concrete into firm, undisturbed soil. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices. Crown top of exposed concrete to drain water away from posts. Protect aboveground portion of posts from concrete splatter.

C. Install gates level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary.

D. Perform cutting, drilling, and fitting required to install decorative metal fencing. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.

F. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

H. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 ADJUSTING

A. Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.4 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099100 Exterior Painting

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

E. Protect finishes from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.

F. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 323310
TACTILE/DETECTABLE WARNING SURFACE TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:
   1. Provide all material, labor, equipment and services necessary to completely install tactile warning surface on new or existing surfaces.

B. RELATED SECTIONS
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 32 13 13 - Site Concrete Improvements

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s literature describing products, installation procedures and routine maintenance.

B. Samples for Verification Purposes: Submit two tile samples minimum, 6 inch by 6 inch of kind proposed for use.

C. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.

D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on Surface Applied tactile tile system as certified by a qualified independent testing laboratory.

E. Maintenance Instructions: Submit copies of manufacturer’s specified maintenance practices for each type of tactile tile and accessory as required.

1.4 QUALITY ASSURANCE

A. Provide Surface Applied tactile tiles and accessories as produced by a single manufacturer.

B. Installer’s Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces that comply with detectable warnings on walking surfaces section of Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES.

D. California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR). Title 24, Part 1, Articles 2, 3 and 4 and Part 2, Section 205 definition of “Detectable Warning”. Section 11B-406 for “Curb ramps, blended transitions and islands” and Section 11B-705 for “Detectable warnings and detectable directional texture”.

1.5 DELIVERY, STORAGE AND HANDLING

A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings and tile type shall be identified by part number.

B. Tiles shall be delivered to location at building site for storage prior to installation.

1.6 SITE CONDITIONS

A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive tactile tiles for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40°F in areas where work is completed.

B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.

C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.

D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

1.7 EXTRA STOCK

A. Deliver extra stock to storage area designated by engineer. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for Surface Applied tactile tiles. Furnish not less than two (2) percent of the supplied materials for each type, color and pattern installed.

1.8 WARRANTY (DETECTABLE WARNINGS AND DIRECTIONAL TEXTURE)

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of detectable warnings and directional surface products that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly.
      b. Degrade significantly means that product maintains at least 90 percent of its approved design characteristics, as determined by the authority having jurisdiction.
   2. Warranty Period: Five years from date of Final Completion.
   3. Authority: California Building Code Section 11B, Division of the State Architect Interpretation of Regulations (IR) 11 B-2, 11B-3 11B-4.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. Engineered Plastics Inc., Armor Tile.
   2. ADA Solutions, Inc., North Billerica, MA.

B. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Section 11B-705.1, IRs 11B-2, 118-3 and 11B-4 and the California Accessibility Reference Manual.
   1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.9 inch at base tapering to 0.45 inch at top, height of 0.2 inch, with center-to-center spacing of 2.35 inches and corner domes spaced at 0.896 inch from the corner edges of tile; Provide raised truncated domes in a square grid (in-line) pattern.
      a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.
   2. Detectable Warning Texture (Truncated Domes): Plastics/Composites: Armor Tile, ADA Tactile Systems by Engineered Plastics Inc., North Billerica, or equal.

C. The Vitrified Polymer Composite (VPC) Surface Applied Tactile Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc. Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.

D. Color: Yellow conforming to Color No. 33538 of SAE AMS-STD-595A. Color shall be homogeneous throughout the tile.

2.2 MATERIALS

A. Fasteners: Color matched, corrosion resistant, flat head drive anchor: W diameter x 1 3/4” long, or manufacturer’s recommended fasteners.

B. Adhesive and Sealant: Manufacturer’s recommended adhesive and sealant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Surface Applied: The following installation instructions shall be used for tactile warning tiles installed at existing concrete surfaces.
   1. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
   2. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.
   3. Ensure that surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to Engineer.
   4. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. Use thin permanent marker. Remove tile when done marking its location.
   5. The surface to receive the detectable warning surface tile (not recommended for asphalt) is to be mechanically cleaned with diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a rag soaked in Acetone.
   6. Immediately prior to installing the detectable warning surface tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured for minimum of 30 days.
   7. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.
   8. Apply the adhesive on the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2” width of the adhesive locator. A 3 x 4 foot tile will typically require an entire tube of adhesive.
   9. Set the tile true and square to the curb ramp area as detailed in the design drawings.
   10. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3W using the recommended diameter bit. Drill through the tile without hammer option until the tile has been successfully penetrated, and then with hammer option to drill into the concrete.

11. Immediately after drilling each hole, and while still applying foot pressure, vacuum, brush or blow away dust and set the mechanical fastener as described below, before moving on to the next hole.
12. Mechanically fasten tiles to the concrete substrate using a hammer to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the hammer, taking care to avoid any inadvertent blows to the truncated dome or tile surface. A plastic deadblow or leather hammer is recommended.
13. Working in a sequence that will prevent buckles in the tile, proceed to drill and install all fasteners in the tile's molded recesses.
14. Following the installation of the tiles, the perimeter caulking sealant should be applied. Follow the perimeter caulking sealant manufacturer's recommendations when applying. Tape all perimeter edges of the tile and also tape the adjacent concrete back 1/2" from the tile's perimeter edge. Tool the perimeter caulking with a plastic applicator or spatula to create a straight edge in a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter caulking sealant.
15. Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to avoid tracking.
16. If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other, in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Tile is required in order that the truncated domes on adjacent tiles line up with each other.
17. In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is advisable. All cuts should be made prior to installation of the tiles.
18. If installing adjacent tiles, care should be taken to leave a 1/8 inch gap between each. If tiles are custom cut to size, and if pre-molded recesses (to receive fasteners) are removed by the cut, then any truncated dome can be center-drilled with a 5 inch through hole, and countersunk with a suitable bit, to receive mechanical fasteners. New holes should be created no closer to the edge of the tile than any of the other perimeter fastener pre-molded recesses. Care should be taken to not countersink too deeply. Fasteners should be flush with the top of the truncated dome when countersunk properly.
19. Adhesive or caulking on the surface of the Tile can be removed with Acetone.

B. Wet Set: The following installation instructions shall be used for tactile warning tiles installed at new concrete surfaces.
1. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
2. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.
3. Ensure that surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to Engineer.
4. Set the tile true and square to the curb ramp area as detailed in the design drawings.
5. Immediately prior to installing the detectable warning surface tile, the wet concrete surfaces must be inspected to ensure that it is clean and free of debris.

6. Do not remove protective plastic covering on detectable warning tile product until tile is installed and concrete is fully cured.
7. Slowly press the detectable warning tile into the wet concrete until the base of the truncated domes is flush with the adjacent concrete. Do not stand on the tile during installation. Tap the detectable tile with a rubber mallet as required to ensure all edges are flush with concrete. Install anchors into wet concrete as specified per manufacturer's recommendation and ensure that the anchors are flushed with the detectable tile surface. Provide weight to the detectable tile surface if "floating" occurs after tile placement. All detectable tile edges shall be flush with adjacent concrete.
8. While the concrete is workable, a 1/8" deep troweled edge shall be installed around the tile perimeter. Finish the concrete as required per specifications. Ensure concrete edge do not have any low areas that collect water.
9. Set the tile true and square to the curb ramp area as detailed in the design drawings.
10. If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other, in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Tile is required in order that the truncated domes on adjacent tiles line up with each other.
11. In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is advisable. All cuts should be made prior to installation of the tiles.
12. Remove protective plastic sheeting after all post-installation treatments are complete and the concrete has cured.

3.2 CLEANING AND PROTECTING

A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by methods recommended by manufacturer.

END OF SECTION

SECTION 323313
BICYCLE RACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Manufactured site furnishings as follows

1. Coiling style bicycle racks.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, including assembly and installation instructions.

B. Shop Drawings: Show fabrication and installation details for site furnishings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store site furnishings in manufacture’s unopened packaging until ready for installation and protected from weather, moisture, soiling, abrasion, and humidity.

1.5 COORDINATION

A. Coordinate installation of anchorages for bike racks. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 BICYCLE RACKS

A. Bicycle Racks: Continuous coiling style bicycle rack as follows:

1. Basis of Design: Drawings and specifications are based on the following:

a. Belson Outdoors; Bike Coil Bike Rack, 6 capacity, Model BRBC-6 with in-ground mount kit Model BC-IGM.

1) Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:

a) Terra Bound Solutions.
b) Approved equivalent.

2. Characteristics:

a. Bicycle Capacity: 6 bikes per rack.
b. Material: Round steel tubing, 1.9 inch diameter x 0.95 inch wall thickness.
c. Height/Width/Diameter: 32 inches nominal.
d. Length: 46 inches nominal, verify with manufacturer.
e. Number of Coiles: 3.
f. Finish: Powder coat, gloss finish, color as selected by Architect from manufacturer’s standard colors.
g. Anchorage Method: Surface mount bolted to embedded anchor plate inserts.

2.2 FERROUS METALS

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

B. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.3 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide Type 304 stainless-steel fasteners.

B. Provide tamper-resistant screws for exposed fasteners unless otherwise indicated.

C. Post-Installed Anchors: Torque-controlled expansion type or chemical type and as indicated on Drawings.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 FABRICATION, GENERAL

A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Fabricate bends in pipe by hydraulic bending with a mandrel.

C. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

2.5 STEEL FINISHES

A. Powder-Coat Finish: Prepare, treat, and coat metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install bicycle racks in accordance with manufacturer’s written installation instructions and as indicated on Drawings.

B. Provide anchorage devices and fasteners where needed to secure site furnishings to in-place construction.

C. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

3.3 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Protect finishes from damage during construction period with temporary protective coverings. Remove protective covering at time of Substantial Completion.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 328400
LANDSCAPE IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all materials, labor, equipment and services necessary to furnish and install Landscape Irrigation System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded. The extent of the underground landscape irrigation system is shown on the drawings. The Contractor shall carefully review the plans and specifications and if they feel that more equipment is needed, they shall include that in the bid. All extra work to achieve full coverage shall be at the Contractors expense. Sprinkler systems shall be complete, operative, automatic and provide full coverage of the planted areas.

B. Irrigation systems shall be constructed to the sizes, grades and locations shown on the plans. Irrigation pipelines shown on the plans are essentially diagrammatic. Locations of all irrigation improvements shall be established by the Contractor at the time of construction. Typical spacing of the sprinklers are shown on the plans and shall not be exceeded, except by written permission of the Owner's authorized representative.

C. The system has been designed to a pressure as indicated in these specifications. The Contractor shall test the mainline prior to starting any work and verify that such pressure does exist. If it does not, the Contractor shall notify the Owner at once for a ruling before starting work. If the Contractor does not test prior to starting work, all corrective work shall be at the Contractors expense.

1.2 RELATED SPECIFICATION SECTIONS

Division 31	EARTHWORK
32 90000	LANDSCAPE CONSTRUCTION
Division 03	CONCRETE
Division 26	ELECTRICAL

1.3 STANDARDS

A. Materials and installation shall conform to all State and Local codes and regulations governing the trades included in this work. Requirements of these plans and specifications not conforming therewith, but exceeding code requirements, then the plans and specifications shall govern.

1.4 EXPLANATION AND EXAMINATION OF SPECIFICATIONS AND PLANS

A. Due to the scale of the Drawings, it is not possible to indicate offsets, fittings, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of their work and plan their work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner so that conflicts between irrigation systems, planting, utilities, and architectural features will be avoided.

B. Notes on Drawings: Work called for on the Drawings by notes shall be furnished and installed whether or not specifically mentioned in the Specifications.

C. It shall be the responsibility of the Contractor to carefully examine the site, plans and specifications relating to this work for completeness, accuracy and clarity. Any conflict, error, or clarification shall be immediately brought to the attention of the Owner's authorized representative in writing to obtain a ruling. Failure to do so prior to bidding shall result in any corrective work necessary shall be completed at the Contractor's expense.

D. It is the intent of these specifications and plans to form a guide to accomplish the work of installing a complete sprinkler system which will operate in an efficient and satisfactory manner according to the workmanlike standards established for the irrigation industry. Therefore, any items not specifically noted, but necessary for a complete installation, shall be furnished and installed under this contract.

E. Manufacturer printed instructions shall also be a part of these specifications and shall prevail over these specifications. The Contractor shall be responsible to provide such details and instructions to the inspecting person for approval or rulings.

F. All general and specific notes shown on the drawings and details herein shall take precedence over these specifications. All work designated on the drawings by notes shall be furnished and installed.

1.5 PERMITS AND INSPECTIONS

A. The Contractor shall obtain and pay required fees to any governmental or public agency. Permits for the installation or construction of the work included under this Contract, which are required by legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. The Contractor shall also arrange for and pay costs in connection with inspections and examination required by these authorities.

1.6 GUARANTEE

A. Irrigation system shall be guaranteed for a period of one year from the date of final acceptance. Any repairs required are to be completed by the Contractor in a timely manner at no additional cost to the Owner.

1.7 OPERATIONS AND MAINTENANCE INSTRUCTIONS / RECORD DOCUMENTS

A. Two copies of equipment operations, maintenance instructions, and wire diagrams shall be furnished to the Owner prior to final acceptance. Two copies of control valve station charts (color coded reduced Irrigation Plan with plastic waterproof lamination) showing watering zones and stationing shall be provided and mounted in the controller pedestal.

B. The Contractor shall furnish one set of reproducible Record Documents (As-Built drawings) in form of 24 lb bright white bond paper.

1. Label first page of each document, or set of documents, "RECORD DRAWINGS" in neat large printed letters on lower right hand corner. Record information concurrently with construction progress. Do not conceal any work until required information is recorded on a daily basis.

2. Drawings: Legibly mark to record actual construction:
   a. Horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements. Give sufficient horizontal and vertical dimensions to accurately trace route and invert of each concealed line or item. Accurately locate each capped, plugged, or stubbed line.
   b. Field changes of dimension and detail.
   c. Changes made by Field Order, by Addenda, or by Change Order.
   d. Details not on original Contract Drawings.

3. Deliver all Record Documents (As-Builts) to Landscape Architect. Accompany submittal with transmittal letter in duplicate, containing:
   a. Date.

b. Project title.
c. Contractor's name and address.
d. Title and number of each Record Document (As-Built).
e. Signature of Contractor or his authorized representative.

1.8 SUBMITTALS

A. Within the required time period stated in the General Provisions, the Contractor shall submit six (6) copies of complete lists of proposed materials to Landscape Architect including manufacturer's name and catalog numbers.

B. Shop drawings shall follow (six copies) for equipment including dimensions, capacities, and other characteristics listed in product specifications. Materials and equipment shall not be ordered until given written approval by Landscape Architect.

1.9 DEFINITIONS

A. Piping: All pipe fittings, valves, and accessories as required for a complete piping system.

B. PVC: Polyvinyl Chloride.

C. Agencies and Organizations:

1.	ASTM	American Society for Testing and Materials
2.	AWWA	American Water Works Association
3.	IAPMO	International Association of Plumbing and Mechanical Officials
4.	CEC	California Electrical Code
5.	UL	Underwriter's Laboratories

1.10 UNDERGROUND OBSTRUCTION

A. The Contractor shall verify all underground obstructions, and / or utilities, existing or proposed, prior to trenching. Contractor shall avail themselves of any “as built” drawings of the site, Underground Service Alert (USA) 1-800-227-2600 and records of existing and proposed site work. This shall also include verifying between proposed irrigation work and existing / proposed underground utilities. Contractor shall call for a ruling by the Owner’s Authorized Representative prior to work to obtain a ruling in the event of a conflict.

B. The Contractor, after availing themselves to the existing record drawings, Underground Service Alert and coordination with other trades installing underground utilities and excavation operations incurs and damages any existing utility not identified, the Contractor shall stop work and notify the inspector on site, obtain a ruling and repair the damage.

1.11 WORKMANSHIP

A. The Contractor shall have experience and demonstrated ability in the installation of irrigation systems of this type. No work shall be completed without supervision. All work shall be installed by skilled persons proficient in the trades required, in a neat, orderly and organized manner, with the recognized standards of craftsmanship developed for the industry and as described in the plans, specifications and manufacturers installation instructions.

1.12 PROTECTION TO THE PUBLIC HEALTH AND WELFARE

A. The Contractor in the course of their work shall make every effort to guard the public health, safety and welfare during construction. This shall include erection of barricades, night warning lights and all necessary devices required to protect the public health and welfare or as required by existing governmental codes. The Contractor shall accept any and all liabilities arising from accident or injury on the job and after construction. All equipment which protrudes above grade shall be installed against a structure or an appropriate barricade shall be erected to protect public safety.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials and equipment to be used shall be as outlined on the irrigation legend, or as described in the irrigation notes and irrigation specifications. All materials shall be new and unused.

B. All specified materials, products and manufacturers are relevant to describe the required quality and features of a particular component of the irrigation system, however, the specific product or manufacturer noted is to be construed to be followed by the words, “or approved equal”.

2.2 PIPELINES / SLEEVES

A. Irrigation Piping:

1. 2" thru 3": Pressure pipe / upstream of control valve (mainline pipe): PVC Schedule 40 solvent weld pipe, PVC Material ASTM D1784, Cell Class 12454B, Pipe Design ASTM D1785 & compliance with all NSF & IAPMO (UPC) requirements.

2. 4” thru 6”: Pressure pipe / upstream of control valve (mainline pipe): PVC Class 200 gasketed pipe, pressure rating 200 psi, SDR 21, PVC Material ASTM D1784, Cell Class 12454B, Pipe Design ASTM D2241 & Gasket Material ASTM F477.

3. 1" thru 2 1/2": Circuit pipe / downstream of control valve (lateral pipe): PVC Class 200 solvent weld pipe, pressure rating 200 psi, SDR 21, PVC Material ASTM D1784, Cell Class 12454B & Pipe Design ASTM D2241.

4. 2" and larger: Sleeving under paving: Sleeves 2” thru 3” size are to be PVC schedule 40 pipe, PVC Material ASTM D1784, Cell Class 12454B, Pipe Design ASTM D1785 and sleeves 4” and larger are to be PVC Class 200 pipe, pressure rating 200 psi, SDR 21, PVC Material ASTM D1784, Cell Class 12454B & Pipe Design ASTM D2241.

5. Pipe shall be continuously and permanently marked with the following information: Manufacturer's name or trademark, nominal pipe size, schedule and type of pipe, pressure rating in PSI and (NSF, IAPMO & AWWA) seals of approval.

B. Plastic pipe shall be as called for on the plan and extruded from PVC 1120/1220 and shall meet commercial standards CS 256-63. Class and schedule of pipe shall be as called for in the plans. Strict conformance with the manufacturers recommended installation instructions is required. Painted galvanized steel (schedule 40), threaded bronze nipples, copper or painted ductile iron pipe is to be used for any pipe installed above grade. Fittings for above grade piping are to be consistent with pipeline material. Sun burned pipe or pipe that has been abused in shipping and handling is not to be used.

C. The Contractor is to install concrete thrust blocks as outlined in the thrust block detail and as recommended by the pipe & fitting manufacturers to secure all changes in direction or dead ends of all mainline pipe. The Contractor is to use rebar as needed if necessary to insure the stability of the pipe. Where concrete thrust blocks cannot be installed against continuous native subgrade, the Contractor is to install ductile iron mechanical joint restraints. No bending, or curving of pipe will be allowed, except as permitted by the pipe manufacturer. Pipe manufacturer must be approved prior to ordering materials.

D. Where piping on the plans is shown under paved areas, but is running parallel and adjacent to planted areas, the intent of the plans is to install the piping in the planted area. PVC Sch. 40 / Class 200 sleeves are to be used with all pipe and wire installed under hardscaped surfaces over eight feet (8'-0") wide or wider.

E. Where pipeline routing changes occur in the field, the Contractor is to size the pipe so that a flow velocity of 5.0 feet per second is NOT exceeded. The minimum pipe size is 3/4" and 11/4" pipe is not used due to its limited flow range. The following is a basic guide for sizing lateral pipes in the field:

1. 3/4" Pipe – Not Used
2. 1" Pipe - 0 gpm thru 12.0 gpm
3. 11/2" Pipe - 12.1 gpm thru 30.0 gpm
4. 2" Pipe - 30.1 gpm thru 55.0 gpm
5. 2 1/2" Pipe - 55.1 gpm thru 85 gpm

2.3 PIPELINE FITTINGS

A. Fittings:

1. For PVC solvent weld plastic pipe, 2" thru 3" mainline fittings: PVC Schedule 80 socket fittings (ASTM A2564, D2466, D2464 & D2467), Type 1, Grade 1. All mainline fittings are to be PVC Schedule 80 type with solvent weld or threaded connections.
2. For PVC class 200 gasketed pipe, 4” thru 6” mainline fittings: Ductile iron deep bell gasketed fittings as manufactured by LEEMCO, or approved equal. See manufacturers instructions and recommendations. No angular deflection of mainline pipe at the fitting bell end is allowed. For automatic valve connections to large mainline (4” thru 6”) pipe, Romac 202N ductile iron service saddle with double stainless steel straps may be used.
2. For PVC solvent weld plastic pipe, 1" thru 2 1/2" lateral fittings: PVC Schedule 40 socket fittings (ASTM A2564, D2466, D2464 & D2467), Type 1, Grade 1. All lateral fittings (downstream remote control valve) not specifically noted as PVC Schedule 80 type in the specifications or irrigation details are to be PVC schedule 40 type with solvent weld or threaded connections.
3. For connections between main lines and remote control valves: Schedule 80 PVC fittings and TOE nipples (threaded both ends), see Irrigation Details.
4. When connection is plastic to metal, Schedule 80 TOE nipple shall be used.
5. Teflon tape shall be used on all small diameter (½" to 3") threaded connections. No liquid or paste pipe thread sealants are allowed.

B. Risers to irrigation heads: Shall be as noted on Irrigation Details.

C. Solvent Weld Adhesive: Weld-On cement & primer appropriate for size & type of pipe and fittings. See manufacturers instructions and recommendations. Note weather and temperature limitations for use. Use primer for all joints, mainline and lateral pipe connections.

2.4 VALVES / CONTROL WIRE

A. Automatic Control Valves: Globe / Angle valves operated by low-power solenoid, normally closed, with manual flow adjustment. Sizes and types as shown on drawings. Low voltage electrical connections to valves shall have a minimum 24" coiled loop to each valve in valve box, see details. Valves shall be installed in a heavy duty plastic valve box with bolt down lid. Install one valve per valve box, no exceptions.

B. Control Wire – Traditional Wired Stations: Single strand Copper, UL approved for direct burial, minimum size #14-1 (hot wires) & #12-1 (common wires) rated for 600 volts as manufactured by Paige Electric, or approved equal. Common wire to be white/green, control wire to be red/yellow, spare hot to be black, spare common to be blue. All low voltage valve wiring is to be installed adjacent to pipe and taped into bundles at ten (10'-0") foot intervals. Wiring is to be neatly organized and loosely laid in trench and not stretched or pulled tight with expansion coils (24") at all changes in direction. All low voltage “hot” wiring is to be continuous, between the valve location and the designated controller. Low voltage wire shall be color coded by each Controller. Contractor is to install a minimum of one spare hot wire and one spare common wire per Controller looped to all remote control valves. Spare wires are to be color coded per Controller.

C. Control Wire - 2 Wire Path: Rainmaster #TW-CAB-14 2-wire cable with two single strand Copper, UL approved for direct burial, minimum size #14-2 double jacketed and rated for 600 volts as manufactured by Rainmaster, or approved equal. All low voltage communication cable (2 Wire Path) is to be installed in 1 1/2” PVC schedule 40 electrical conduit with long sweep elbows entering and exiting all valve boxes and splice boxes. Communication cable (2 Wire Path) installed in conduit is to be installed adjacent to mainline pipe where possible. Communication cable routing is to be clearly marked on the as built plans.

D. Control Wire Connectors – Traditional Wired Stations: Valve wire connectors to be 3M DBY / DBR Direct Bury splice kits are to be used for all wire connections and spare wire ends. All splices are to be located in a valve box and no direct bury splices are allowed.

E. Control Wire Connectors – 2 Wire Path: Valve to decoder wire connectors and all other splices are to be Rainmaster #TW-SPLICE-14 waterproof splice kits. Rainmaster #TW-SPLICE-14 splice kits are to be used for all wire connections and spare wire ends. All splices are to be located in a valve box and no direct bury splices are allowed.

F. Control Wire Marking: T. Christy Enterprise, Inc. Waterproof Irrigation I.D. Tag or approved equal (714) 771-4172.

G. Control Valve Boxes: Applied Engineering heavy duty plastic valve boxes with heavy duty bolt down lids, or approved equal. See Irrigation Details for model numbers and sizes.

H. Control Valve Box Marking: Heat imprinting with appropriate controller and station number.

2.5 IRRIGATION HEADS

A. Spray Head: Molded plastic body with plastic nozzles. Refer to schedule on drawings. Manufacturer's numbers are listed with description.

B. Rotor Head: Molded plastic and stainless steel construction. Gear driven with lockable arc adjustment and matched precipitation rate nozzles. Refer to schedule on drawings. Manufacturer's numbers are listed with description.

C. Irrigation heads adjacent to concrete walks, mow strips or other paved areas shall be offset 3" to permit edging without damage to irrigation equipment. Irrigation heads are to be set at grade. Irrigation heads are to be adjusted so that no spray hits buildings, fences, walls, or hardscaped surfaces. Install anti-drain check valves under all irrigation heads that weep or show drainage after operation.

2.6 GATE VALVES

A. 1" thru 3" Size: Class 125 bronze gate valve, 200 psi WOG, manufactured domestically made of cast bronze material and cross handle with non rising stem as manufactured by NIBCO, or approved equal. Solid wedge with screw in bonnet gate valve with threaded connections resistant to dezincification. Contractor is to provide Owner with two (2) “T” handle operation keys.

B. 4" thru 6” Size: Resilient seat ductile iron gasketed joint gate valve rated for a minimum of 200 psi, manufactured domestically by NIBCO, Waterous or approved equal. Contractor is to provide Owner with two (2) “T” handle operation keys.

2.7 QUICK COUPLER VALVES

A. Two piece valve with heavy duty brass construction with vinyl cover and single lug operation. Contractor is to supply Owner with three (3) quick coupler keys and three (3) hose swivels. See Irrigation Legend and Details for detailed descriptions.

2.8 CENTRAL CONTROL SYSTEM

A. Rainmaster iCentral internet based central with additional five (5) years of access provided in addition to the five (5) years that are provided with the purchase of the controller for a total of ten (10) years of premium service provided. Contractor is to provide all data input and programming required for a complete automatic control system with online access for the District. Contractor is responsible for training up to 6 persons appointed by the District in the use of this online central system.

2.9 HAND HELD RADIO SYSTEM

A. The irrigation controller is to be capable of communicating with a Rainmaster PROMAX hand held maintenance radio for the purpose of remote activation of the irrigation system. Contractor is to provide two (2) PROMAX remote radio kits (#PROMAX) to the District complete with charger, transmitter, receiver and carrying case with all cables and appurtenances required. Contractor is to program the both remotes to work with irrigation controller.

2.10 FIELD SATELLITE CONTROLLER

A. Irrigation controller shall be as specified on the plans. Pedestal mount shall have a concrete base. The installation shall be in accordance with the manufacturers instructions and recommendations. All electrical connections to the controller shall be the responsibility of the Contractor and shall be UL approved and meet all applicable codes and regulations. All wiring from the electrical source to controller shall be installed in UL approved electrical conduit. Contractor is responsible for training up to four persons appointed by the Owner in the operation of the field satellite controllers.

B. Contractor is to install iCard cellular modem for internet access to the irrigation controller ‘H’. Irrigation controller is to be online ready.

2.11 IRRIGATION BOOSTER PUMP STATION

A. Not used for this project.

2.12 VALVE BOXES

A. All valves, manual or automatic shall have a valve box, set flush with grade. All valve boxes shall be of heavy duty plastic construction with heavy duty bolt down lids. Valve boxes are to be manufactured by Applied Engineering, or approved equal. Maximum of one (1) valve per valve box, no exceptions. Placement of the valves within the valve boxes shall allow for proper servicing and maintenance space, or the installation will be rejected.

2.13 AIR RELIEF VALVES

A. Air relief valves shall be installed at high elevation areas of the mainline pipe and at dead end runs. Air relief valves are to be located in the field where high elevation points can be determined. Contractor is to submit a shop drawing showing the proposed installation locations for review and approval.

2.14 BACKFLOW PREVENTION DEVICES

A. The backflow prevention device shall be as called for on the Civil Site Plans and shall be acceptable to all applicable codes and regulations. Installation is to be by Site Plumbing Contractor. Contractor is to coordinate all work in the field with other trades.

2.15 OTHER MATERIALS

A. Materials not specifically indicated but necessary for proper execution of this work shall be of the first quality as selected by the Contractor subject to the acceptance of Architect.

B. All materials appearing in the legend and details of the irrigation drawings are part of this job. Contractor is responsible for installation according to drawings and details. The system shall efficiently and uniformly irrigate all areas and perform as required by these plans and specifications.

PART 3 - EXECUTION

3.1 IRRIGATION SYSTEM DESIGN

A. Irrigation system is designed for a minimum water pressure of 60 psi at the discharge of the backflow prevention device, or 45 psi at the City water supply.

B. Verify the design pressure provided at P.O.C. prior to system installation and report any discrepancies in writing to the Architect. Failure to inform the Architect of any discrepancy in design pressure seven working days prior to installation of the irrigation system shall institute the responsibility of corrective action to the Contractor, at no expense to the Owner.

3.2 IRRIGATION STAKING

A. The location of all sprinklers, valves, piping and other irrigation improvements shall be staked out by the Contractor. All staking and measurements shall be taken from permanent objects,

buildings, or other permanent hardscape features including survey bench markers, and are NOT to be taken from non-permanent boundaries such as turf boundaries which are subject to modification. All measurements shall be made in feet and inches, rounding to the nearest inch. All variations from the plans are to be continuously updated on a daily basis on the record (as built) drawings. The Contractor is to present the areas staked to the Landscape Architect for review and approval prior to starting work. The Contractor is to make the adjustments in staking requested by the Landscape Architect at no additional cost to the Owner.

B. In turf and planter areas, the Contractor is to stake the tree and shrub locations prior to layout of the irrigation system to get approval from the Landscape Architect and District in the field prior to trenching. Contractor is to use color coded flags to stake plant materials by variety. Landscape Architect or District may move plants, delete or add plants during the staking review process. Contractor is to make changes in the field and on the as built plans at no additional cost to the Owner. After the plant layout has been staked, reviewed, adjusted and approved, the Contractor is to stake the bubbler locations for each plant or tree. Bubblers are to be located within the plant water basin on the uphill side of the plant or tree. Bubblers that are too far from the plant or tree will need to be relocated within an acceptable difference. The plant or tree rootball is to have direct access to irrigation water from the intended bubbler. Sloppy or non-compliant work will be rejected.

3.3 EXCAVATION, BACKFILL

A. Trenches for irrigation pipelines and sleeves shall be excavated either by hand or machine and shall be of sufficient width to permit proper handling and installation of the pipe and fittings. The backfill shall be compacted and evened off with the adjacent soil level. Select fill material or sand shall be used if soil conditions are rocky, or have debris. No material over 3/8" shall be allowed near the pipe, 6" below it, or 6" above the pipe. Backfill shall be made early in the morning when the soil and pipe temperatures are the same. Pipe to be installed with a minimum cover of 18" for mainline pipe and 12" for lateral pipe with spray heads and 18" for lateral pipe with rotors. Backfill shall be in 6" (lifts) increments. Each (lift) increment shall be compacted as needed to prevent settlement with tamping machine. Backfill material is to be brought to the optimum moisture content prior to starting compaction operations.

B. Contractor shall compact trench fill material as required to prevent settling of trenches. Contractor is to guarantee trenches against settling for a period of one year from the date of final acceptance by the Owner. Contractor is to fill, compact and seed settled trenches during this time at no additional cost to the Owner.

C. All pipe in the same trench shall have a minimum clearance of 4" from each other. Pipelines are not to be stacked vertically in the same trench. Pipes and wires or conduit are to have a minimum clearance of 12" from each other. Final fill over trenches shall be compacted to a level grade with no depressions.

3.4 ROAD, DRIVEWAY, PARKING LOT AND SIDEWALK PIPELINE CROSSINGS

A Any pipe, wire or communication cable that crosses any hardscaped surface eight feet (8'-0") or wider, shall be installed in a PVC sch. 40 / class 200 sleeve that is a minimum of two times larger than the pipe or wire bundle being sleeved. Sleeves are to have a minimum trench cover of 18" deep. Pipelines and wires that are to be installed below existing hardscaped improvements are to be installed in a sleeve as noted above, by horizontal directional boring. No cutting and patching of any hardscaped surface will be permitted without written permission of the Owner’s authorized representative. Newly paved areas are to be protected and preserved from construction damage. Jacking and hydraulic (water jet) driving are not permitted. The minimum sleeve size is two (2") inch. The Contractor is to verify the inside and outside diameters of pipes and wire bundles being sleeved to insure proper fit and installation. Irrigation pipelines and wires are to be installed in separate sleeves. No more than one (1)

irrigation pipeline is allowed per pipe sleeve. Low voltage wires may be bundled with communication cable and installed in an appropriate size wire sleeve in conformance with CEC requirements for wires installed in conduit.

B. If approval to cut and patch a hardscaped surface has been obtained, the Contractor shall make cuts by a pavement / concrete saw or other approved means. Where any cutting or breaking of hardscaped surface work is necessary, it shall be removed and replaced by the Contractor conforming to all prevailing project specifications and requirements. Cuts are to be made along existing scoring lines or other markings to minimize negative visual aesthetics. Barriers and night lighting shall be erected to protect the public health welfare and safety. If approval to cut and patch a hardscaped surface is denied, the Contractor shall make the crossing by using horizontal directional boring. All materials and labor for all sleeves and crossings, whatever method, are to be supplied by the Contractor at no additional cost to the Owner.

C. Backfill shall be compacted to 95%. The Owner reserves the right to test such backfill. If the backfill does not meet the required 95% compaction, the Contractor shall recompact the trench. The Contractor shall pay for all additional testing until the work meets the specifications.

3.5 PIPING INSTALLATION

A. General: Support piping without strain on joints or fittings and allow for piping expansion and contraction. "Snake" pipe into trench in accordance with manufacturer's recommendations to allow for expansion. Lay on solid sub-base, uniformly sloped.

B. The Contractor shall examine all other portions of working drawing and plan trenching and pipe routing and depth so that no conflicts will arise between irrigation and any other work. Any corrective action will be the Contractor's responsibility at no further expense to the Owner. Contractor is to endeavor to route mainline pipes a minimum of fifteen feet (15’-0”) from trees and is to get permission to install mainline pipe closer in tight locations from the Owners Authorized Representative.

C. Joints:

1. PVC Solvent Weld: Pipe shall be cut square and reamed to full size. Check for assembly prior to solvent weld. Remove excess solvent. All assembly shall be in accordance with manufacturer's recommendations, including use of primer on 3/4" pipe or larger.

2. Steel or PVC Schedule 40 Threaded: Pipe shall be cut square and reamed to full size. Threads shall be full cut, true and tapered. Teflon tape suitable for conveyed fluid shall be applied to male thread only.

3. Open Ends: Open ends of piping shall be capped during progress to preclude foreign matter. All pipe shall be assembled free from dirt and pipe scale.

D. The Contractor shall thoroughly flush all mainline and lateral piping prior to the installation of irrigation heads. Flush entire piping system of all debris.

3.6 IRRIGATION HEAD INSTALLATION

A. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage without overspray on non-planted areas. Flush all lines prior to installation of the sprinkler heads.

3.7 CONTROL WIRE

A. Traditional Wired Stations: Protect wire by running along side mainline piping, maintain 6" separation to mainline. Bundle wires together and tape at intervals of ten (10') feet. Do not tape wire together when encased in sleeve. Minimum cover shall be 18 inches. Connect wires together at valve manifold with Scotchlok connector. Seal splice with 3M DBR splice kit. Tag all control wire splices with approved control wire marker at splices in valve box and in controller.

B. 2 Wire Path: Rain Master #TW-CAB-14 2-wire cable with two single strand Copper, UL approved for direct burial, minimum size #14-2 double jacketed and rated for 600 volts as manufactured by Rainmaster, or approved equal. All low voltage communication cable (2 Wire Path) is to be installed in 1 1/2” PVC schedule 40 electrical conduit with long sweep elbows entering and exiting all valve boxes and splice boxes. Communication cable (2 Wire Path) installed in conduit is to be installed adjacent to mainline pipe where possible. Communication cable routing is to be clearly marked on the as built plans.

3.8 CONTROL VALVE BOX MARKING

A. Imprint valve box lid by heat imprinting with appropriate controller and station number.

3.9 TESTING

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Owner. Mainlines are to be center loaded with the joints exposed. Should any joints be covered before such tests, the Contractor shall, at their expense, uncover, test, and repair the work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.

B. Piping Upstream of control valves (Mainline): Maintain 100 PSI water pressure for a duration of four (4) hours. There shall be no drop in pressure during test except that due to ambient temperature changes. Perform test with control valves installed.

3.10 CONSTRUCTION OBSERVATION

A. Observation of Work:

1. Installation and operations must be approved by the Landscape Architect.

2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Landscape Architect. Any work covered prior to inspection shall be opened to view by the Contractor at their expense.

B. Construction Observation: Periodic site visits shall be required for basic operations and installations during progression of the project. Such site visits will include, but not necessarily be limited to, the following items:

1. Preconstruction meeting.

2. Staking of plant and tree locations prior to irrigation installation.

3. Staking of sprinklers and mainline routing.

4. Mainline, wiring, lateral pipes & valve manifolds prior to backfill.

5. Irrigation coverage test and rough grading.

6. Trees & plants prior to installation, still in containers.

7. Fine grading of turf areas prior to installing sod.

8. Substantial completion to start maintenance.

9. Final acceptance after successful maintenance period.

The Owner will pay for initial construction observation visits, however, any additional visits required due to non-compliance, incomplete work, or substandard performance will be paid by the contractor at a cost of $750.00 per extra visit.

C. Coverage Test: When the irrigation system is completed, the Contractor in the presence of the Landscape Architect shall perform a coverage test of water afforded in the planting areas. The Contractor shall furnish all materials and labor required to correct any inadequacies of coverage disclosed. The Contractor shall inform the Landscape Architect of any deviation from the plan required due to wind, planting, soil, or site conditions that bear on proper coverage. If such corrections or additions are required in the irrigation system, the Contractor shall make all adjustments and corrections without any extra cost to the Owner.

D. Completion of Work: Prior to substantial completion and the start of the maintenance period, the Contractor shall deliver to the Owner a complete set of as built drawings on 24 lbs bright white bond paper, two (2) sets of manuals covering all materials in the irrigation system with a list of local vendors, two (2) keys to each controller, two (2) Rain Master #PROMAX Remote Radio Kits, two (2) sets of all tools required to maintain system in tool boxes, three (3) quick coupler keys, three (3) hose swivels, two (2) mainline gate valve “T” wrenches for each type required, waterproof color coded controller diagrams and extra equipment listed below not installed as part of the project. Irrigation system shall be fully automatic, operable and provide full coverage of the planting areas. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved in writing at proper time. Should it become necessary, due to developed conditions, to occupy any portion of the work before the Contract is fully completed, such occupancy shall not constitute acceptance. The Contractor will not be responsible for any damage caused by the Owner's work forces.

3.11 EXTRA IRRIGATION EQUIPMENT

A. The Contractor shall supply the following extra equipment to be installed at the direction of the Landscape Architect during the project. Each item is to include all piping, wiring, fittings, appurtenances, labor and equipment costs for a complete installation at no additional cost to the Owner. Should any items not be installed as part of the project, the remaining items are to be delivered to Owner as part of project completion documentation.

1. Five (5): Four inch pop up bubblers.
2. Five (5): Six inch pop up spray sprinklers.
3. Five (5): Twelve inch pop up spray sprinklers.
4. One (1): 1" electric valve.
5. One (1): 11/2" electric valve.
6. One (1): 2” electric valve.
7. One (1): Quick coupler valves.
8. One (1): Air relief valve.
9. Two (2): 1 Station Decoders
10. Two (2): 2 Station Decoders
11. Two (2): 4 Station Decoders

All work is to be in compliance with all project specifications and construction details at no additional cost to the Owner. Items not installed as part of the project are to be delivered to the Owner as part of project close out procedures (turn over items).

3.12 MAINTENANCE

A. Adjustments: Irrigation system shall be maintained and adjusted as required to provide proper coverage throughout the 120 day maintenance period. Irrigation system maintenance shall commence upon approval of substantial completion following irrigation installation, planting operations, and general site clean up. Maintenance shall be continued until final acceptance.

B. Irrigation controller shall be set during this time with Owner. Training for persons appointed by the Owner is to be completed during this time. Final acceptance of the project will NOT occur until all training of Owner's personnel is completed.

-- END OF SECTION --

SECTION 329000
LANDSCAPE CONSTRUCTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all material, labor, equipment and services necessary to do all Landscape Construction work and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded. Work is to include, but is not limited to, the following:

1. Soil Testing
2. Clearing, Ripping and Grading
3. Cultivation, Soil Amending and Leaching
4. Furnish and Plant Plants and Trees
5. Fertilization & Mulching
6. Turfgrass Renovation Hydroseed and Sod Installation
7. Weeding
8. Staking
9. Clean-up and Maintenance

1.2 RELATED SPECIFICATION SECTIONS

Division 31	EARTHWORK
32 8400	LANDSCAPE IRRIGATION
Division 03	CONCRETE
Division 26	ELECTRICAL

1.3 STANDARDS

A. Materials and installation shall conform with all State and Local codes and regulations governing the trades included in this work. Requirements of these plans and specifications not conforming therewith, but exceeding code requirements, then the plans and specifications shall govern.

1.4 DEFINITIONS

A. The term approved shall mean by the Architect, and only in writing.

1.5 EXAMINATION OF SPECIFICATIONS, PLANS AND SITE

A. It shall be the responsibility of the Contractor to carefully examine the site, plans and specifications relating to this work for completeness, accuracy and clarity. Any conflict, error, or clarification shall be immediately brought to the attention of the Owner's authorized representative in writing to obtain a ruling. Failure to do so prior to bidding shall result in any corrective work necessary shall be completed at the Contractor's expense.

1.6 PERMITS AND INSPECTIONS

A. The Contractor shall obtain and pay required fees to any governmental or public agency. Permits for the installation or construction or the work included under this Contract, which are required by

legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. Contractor shall also arrange for and pay costs in connection with inspections and examination required by these authorities.

1.7 GUARANTEE

A. Guarantee shrubs, ground covers, and lawn as to growth and health for one (1) year after final acceptance by Owner. The contractor is responsible for replacement of plant materials due to theft and vandalism until final acceptance of the project by the Owner after completion of the specified maintenance period.

B. Guarantee trees to live and grow upright for a period of one (1) year after completion and final acceptance by the Owner. The contractor is responsible for replacement of trees due to theft and vandalism until final acceptance of the project by the Owner after completion of the specified maintenance period.

C. Replace plants which lose more than 30% of their original leaves within the below described time limits.

D. Remove and replace plants within 15 days of notification which fail to conform. Replace with materials as originally specified. Guarantee for replaced materials shall begin with date of replanting and shall be as previously described.

1.8 SUBMITTALS

A. Within the required time period stated, the Contractor shall submit six (6) copies of complete lists of proposed materials to Landscape Architect including source, manufacturers name and catalog numbers.

B. Materials and equipment shall not be ordered until given written approval by Landscape Architect.

C. The Contractor shall confirm availability of plant material, supplies and materials for inclusion in the submittal. If a plant is found not to be suitable or available, the Contractor is to submit a list of three to five appropriate substitutions that are available for selection by the Landscape Architect. Specified plants and trees may not be available locally and are to be secured well in advance and substitutions for these plants may not be allowed.

1.9 UNDERGROUND OBSTRUCTION

A. The Contractor shall verify all underground obstructions and / or utilities, existing or proposed prior to making landscape excavations or installing tree stakes. Contractor shall avail themselves of any as built drawings of the site, Underground Service Alert (USA) 1-800-227-2600 and records of existing and proposed site work.

B. If there is a conflict with the utilities and the planting, notify the Landscape Architect for a ruling prior to planting.

1.10 PROJECT CONDITIONS

A. No plants shall be planted in situations that show obvious poor drainage. Such situations shall be brought to the attention of the Landscape Architect and Owner’s authorized representative. Generally, the drainage problem is to be corrected prior to installing plant material.

B. All landscape areas are to be deep ripped to a depth of twelve inches (12”) below finish grade in two directions. All trees are to have 18" diameter drainage holes that are 10’ deep.

C. The Contractor shall guarantee repair of damage to any part of the premises resulting from leaks, defects in materials, equipment or workmanship. The Contractor shall be liable for any and all accidents resulting from their work, including open holes and trenches during construction.

D. During landscape construction operations keep hardscaped surfaces clean and work areas organized.

E. Landscape concrete mow strips are to be installed so that they do not conflict with site drainage or impede drainage away from buildings. Generally, a minimum 2% slope away from buildings is to be maintained for positive site drainage. Concrete mow strips are not to trap water or cause puddling.

1.11 WORKMANSHIP

A. The Contractor shall have experience and demonstrated ability in the installation of landscapes of this type. No work shall be completed without supervision by a qualified foreman. All work shall be installed by skilled persons proficient in the trades required, in a neat, orderly and organized manner, with the recognized standards of craftsmanship developed for the industry and as described in the plans, specifications and manufacturers installation instructions.

1.12 SOIL & WATER TESTING

A. An independent soil testing laboratory, Dellavalle Laboratory, contact Chad Reenders (559) 922-9299 or approved equal, is to test the existing soil after rough grading operations are completed with a complete fertility assay to evaluate the soils ability to maintain and support the ornamental landscaping. Samples from four (4) locations on the site are to be taken, with two samples from each location, one at four (4") inches in depth, and the second at sixteen (16") inches in depth (eight samples). The soil testing laboratory is also to complete a preliminary screening for detrimental agricultural chemical residue that may be present on site, if these results are positive, notify the Owners authorized representative for a ruling. The contractor is to pay for all required soil tests and consulting time with the soil scientist for detailed recommendations to be submitted to the Owners authorized representative for evaluation.

B. After the soil amending and leaching process has been completed, the Contractor is to take additional samples from four (4) locations on the site, with two samples from each location, one at four (4”) inches in depth, and the second at sixteen (16”) inches in depth (eight samples) to evaluate the progress and effectiveness of the soil amending and leaching work. The contractor is to pay for all required soil tests and consulting time with the soil scientist for detailed recommendations to be submitted to the Owners authorized representative for evaluation. If leaching is not required because no detrimental salts are present in the soil, then the second round of testing is required after the installation of the specified amendments to verify the progress of the soil reclamation process. Testing locations are to be determined by the Landscape Architect.

C. Contractor is to get one (1) irrigation water test with an agricultural suitability analysis by Dellavalle Laboratories and submit the results for review.

1.13 CONSTRUCTION OBSERVATION

A. The Contractor is to coordinate construction observation site visits with the Landscape Architect and District Maintenance Department during the appropriate phases of construction, or as required by the Landscape Architect. The Contractor is to schedule site visits a minimum of one week in advance at the required phases of construction. The following outlines the phases of construction which require a site visit, however it is not limited to the following construction phases:

1. Preconstruction meeting

2. Staking of plant and tree locations prior to irrigation installation.

3. Staking of sprinklers and mainline routing.

4. Mainlines, wiring, lateral pipes, & valve manifolds prior to backfill.

5. Irrigation coverage test and rough grading.

6. Trees & plants prior to installation, still in containers.

7. Fine grading of turf areas prior to sod installation.

8. Substantial completion to start maintenance.

9. Final acceptance after successful maintenance period.

The Owner will pay for initial construction observation visits, however, any additional visits required due to non-compliance, incomplete work, or substandard performance will be paid by the contractor at a cost of $750.00 per extra visit.

1.14 PROTECTION TO THE PUBLIC HEALTH AND WELFARE

A. The Contractor in the course of their work shall make every effort to guard the public health, safety and welfare during construction. This shall include erection of barricades, night warning lights and all necessary devices required to protect the public health and welfare or as required by existing governmental codes. The Contractor shall accept any and all liabilities arising from accident or injury on the job and after construction. All equipment which protrudes above grade shall be installed against a structure or an appropriate barricade shall be erected to protect public safety.

PART 2 - MATERIALS

2.1 PLANTS

A. Conform to list of plant materials on drawings. Contractor is to provide digital photos of representative example of each plant and tree type to be used and submit to Landscape Architect and District for review and comment. Plants and trees are also to be inspected by Landscape Architect and District when delivered to the site, prior to planting, so non-conforming materials can be identified and rejected prior to planting.

B. Plants shall be the best of their kind and class, and of optimum age, and in conformance with the standards of the American Society of Nurserymen.

C. Plants shall have normal, well-developed branch systems and shall not be root or pot-bound. Do not prune or top trees prior to delivery.

D. Delivery to be made not more than 2 days prior to installation unless nursery area approved by landscape architect is established with an automatic irrigation system.

E. It will be the responsibility of the contractor to place material order(s) sufficiently in advance of planting to assure availability of plants in species and size specified. Specified plant and tree varieties may not be available locally. Substitutions for these plants and trees may not be made due to lack of advance planning.

F. No substitutions will be made without approval of the Landscape Architect or authorized

representative.

2.2 SOIL AMENDMENTS AND TOPDRESSING MULCHES

A. Soil amendments (type and quantity) are to be based on the soil test results and recommendations by the soil testing laboratory. The contractor is to include the amendments outlined in part 3.03 of this Section in the bid price. Prices for the soil amendments are to be quoted as unit prices to be adjusted based upon the recommendation of the testing lab. The contractor is to pay for all required soil tests and consulting time with the soil scientist for detailed recommendations.

B. Organic topdressing mulch: Walk on bark as supplied by Superior Soil Supplements, Hanford, CA (559) 904-3372, contact Andrea Fike. Organic topdressing mulch is to be installed in a 3" compacted layer. Mulch depth is to be evaluated at the beginning and at the end of the maintenance period for compliance with the 3" compacted layer requirement. Contractor is to continuously supplement the topdressing mulch as it settles throughout the specified maintenance period to achieve the specified 3" compacted depth in all designated landscape planter areas at the end of the maintenance period. This is essential to suppress weed growth and will be closely evaluated for compliance.

C. Inorganic topdressing mulch: Gray decomposed granite as supplied by Rosenbalms Rockery, Fresno, CA. Inorganic topdressing mulch is to be installed in a 3" compacted thickness and is to be brought to an optimum moisture content and compacted with a water filled drum roller. Contractor is to continuously supplement and compact the topdressing mulch as it settles throughout the specified maintenance period to achieve the specified 3" compacted depth in all designated landscape planter areas at the end of the maintenance period. This is essential to suppress weed growth and will be closely evaluated for compliance.

D. Commercial fertilizer (15-15-15), Best Pre-plant fertilizer (6-20-20 XB), slow release fertilizer Best All Season (19-6-12) with Polyon 43.

E. Gypsum (100% purity) and Elemental Soil Sulfur (100% purity) as supplied by Superior Soil Supplements, Hanford, California, (559) 904-3372.

F. Plant fertilizer tabs: Agriform, Best-Tabs or approved equal, quantities as shown below: 1 gallon plant (2 tabs), 5 gallon plant (4 tabs), 15 gallon plant (6 tabs) & box size tree (8 tabs).

G. Global Premium Humate as supplied by Superior Soil Supplements, Hanford, California, (559) 904-3372.

H. Certificates: In addition to any certificates specified, the Contractor shall furnish a certificate with each delivery of bulk material stating the source, quantity, date, and type of material. All certificates shall be delivered to the Owners authorized representative at the time of each delivery.

I. Samples and delivery tags: The contractor is to submit samples of the materials to be used for inspection and approval. Contractor is to submit all soil amendment delivery tags to the DSA Inspector. Delivery tags are to itemize delivered materials with weights and quantities and Supplier name and contact information. Quantities of all soil amendments to be installed are to be verified as being in compliance with the approved soil amendments to be installed on the project. Soil amendments not verified by delivery slips or other reliable manner are to be verified with additional soil testing as outlined in part 1.12 at the Contractors expense, in addition to the specified soil testing.

2.3 ACCESSORIES

A. Tree Stakes: 2 inches by 2 inches by 10 feet long treated lodgepole or natural redwood. Use two

stakes per tree. See the tree installation detail.

B. Tree Ties: flexible vinyl "Cinch-Tie", manufactured by V.I.T. Products, San Diego, California, (619) 673-1760, and distributed by Horizon Sales, Pleasanton, California, (510) 462-6602. Use a minimum of four 24" ties per tree. See the tree installation detail.

C. Tree String Trimmer Guard: polyethylene "Trim Guard", manufactured by V.I.T. Products, San Diego, California, (619) 673-1760, and distributed by Horizon Sales, Pleasanton, California, (510) 462-6602. Use one Trim Guard per tree in the lawn areas only.

D. Tree Root Barriers: All trees within ten (10'-0") feet of a hardscaped surface, perimeter fence or building are to have root barriers installed that are 24" deep by 24" wide as manufactured by Root Solutions, Inc. and distributed by Vespro Inc., San Rafael, California, (415) 434-3072. Each 24” box tree is to have up to 20 panels and larger box size trees are to have additional panels as required. If the concrete is only on one side of the tree, then 10 panels (centered on the tree) are to be installed in a straight line along the concrete or boundary as recommended by the manufacturer, or if the concrete is on two sides of the tree, then install 10 panels (centered on the tree) on two sides or the 20 panels are to be installed around the perimeter concrete, if concrete is on more than two sides of the tree as recommended by the manufacturer.

E. Top Soil: If required, imported topsoil shall be natural, fertile, friable loam, capable of sustaining vigorous plant growth, free of subsoil, roots, grass, excessive amount of weeds, salt, stone and foreign matter; acidity range of pH 5.5 to 7.5; containing a minimum of 4% and a maximum of 25% organic matter. Obtain approval of the Landscape Architect or Authorized representative for placement. The contractor is to submit a topsoil sample to an approved testing lab for a complete fertility assay for approval prior to importing the material on-site.

F. Import Soil: If required, imported fill dirt shall be tested with a fertility assay from Dellavalle Laboratories to certify that the fill dirt is free of salt, boron or other deleterious minerals or matter prior to delivery and placement on the site. Contractor is responsible for all remediation required for the placement of substandard fill dirt containing salt, boron or other deleterious minerals or matter that may require the installation of additional soil amendments, leaching, additional soil testing, replacement of failed plant materials to bring the non-conforming soil into compliance at the Contractors sole expense.

G. Other Materials: Materials not specifically indicated, but necessary for the proper execution of the work, shall be of first quality as selected by the Contractor subject to approval of the Landscape Architect.

2.4 WEED CONTROL

A. Methods and chemicals shall be suitable with regard to season and shall control weeds and shall be approved by all governing agencies.

B. Treatment shall not damage or impede growth of trees, shrubs, and ground covers to be planted, nor kill or damage any existing plant material specified to remain.

C. Applicator shall be a licensed State of California Agricultural Pest Control Operator, Category E, or as required by all governing agencies.

D. Contractor shall obtain required permits from County Agricultural Commissioner. Weed control treatment shall be in accordance with Federal, State of California, County and local codes and regulations, and shall be safe, not cause a health hazard, nor disrupt or inconvenience continuing business operations of the Owner and neighbors, public street, parking lot and sidewalk use or construction activities.

E. Method of treatment shall be strictly in accordance with manufacturer's recommendations.

F. Method of application and chemicals to be reviewed and approved by the Owners representative.

G. Contractor shall ascertain and insure that all planted areas are weed-free prior to planting and maintain the site weed free during construction and maintenance periods.

PART 3 - EXECUTION

3.1 SITE INSPECTION

A. Locate cables, conduit, piping, and other obstacles prior to beginning excavation. Notify Owners representative of obstacles requiring relocation.

B. Remove rocks and other similar underground obstructions to depths necessary to permit proper installation of lawns and planting.

C. Verify that landscape irrigation system has been properly installed and is fully operational.

D. Verify dimensions shown on plan and notify Owners representative of any discrepancy.

E. Review plant list and consult Owners representative with any questions or concerns.

3.2 GRADING

A. Contractor is to remove weeds and debris from site prior to starting grading operations and is to maintain the site weed free throughout the progress of construction.

B. Contractor is to work soil in a manner which does not cause excessive compaction or clods which will not break easily. Apply water as necessary to obtain optimum moisture content for tilling and planting. The Contractor is to coordinate deep ripping of all landscape areas to a depth of twelve inches (12") to break up compacted areas to improve drainage.

C. After the grades have been reestablished after irrigation trench backfill and prior to planting, the Contractor is to heavily irrigate the site to the point of producing runoff to verify that the site is free draining without puddles or low spots. Contractor is to address grading problems and repeat the test until all puddles and areas of standing water drain within one half hour (1/2 hr). Contractor is to fill settled areas as required. Planting shall not proceed until all grading corrections have been completed and the areas have been retested to confirm conformance.

D. The contractor is responsible for the grading of all planting areas. The grades shall be gently flowing with no abrupt changes. The contractor is responsible to insure that the planting areas have adequate soil and is to fill low areas as needed. The contractor is to grade the areas to drain as intended by the site grading plan by the Project Civil Engineer. Typically the planter areas are to be slightly crowned or cross sloped to insure positive drainage away from planted areas to the perimeter to drain as intended by the Site Drainage Plan. No standing water will be permitted in planter areas where plants and trees are located. Slope surfaces away from buildings at a 2% slope with no pockets of standing water. The contractor is responsible for all import or export of soil and removal of debris, trash, or other elements off site at Contractors expense to provide the Owner with a completed landscape project at no additional cost to the Owner.

E. Provide neat, smooth, and uniform finish grade. Final soil elevations in perimeter areas are to be as noted below. Grades may taper from perimeter areas over a smooth gradual transition.

1. Sodded Turf Areas: 3/4" below the adjacent sidewalks or other hardscape features.
2. Hydroseed Turf Areas: 3/4” below the adjacent sidewalks or other hardscape features.
3. Planter Areas: 3” below the adjacent sidewalks or other hardscape features.

F. Notify Owners representative upon completion of grading for approval and to verify the smoothness and accuracy of fine grading and clod-free condition of planting surface. No planting is to be started prior to obtaining the approval of the fine grading from the Owners authorized representative.

G. Install concrete mow strips between all turf and planter boundaries. Install the mow strips as shown in the Concrete Mow Strip Detail and as outlined in the project plans and specifications. Contractor is to insure that concrete mow strips do not interfere with site drainage and do not trap water or cause puddling.

3.3 SOIL PREPARATION

A. Soil Amendments, Cultivation and Weed Control:

1. The contractor is to cultivate the soil amendments into the top eight (8") inches of soil. The following soil amendment types and quantities are to be included in the bid. Pending the results of the soil tests, and recommendations of the soil testing laboratory, adjustments to the types and quantities of soil amendments to be used may be necessary. The contract price will be adjusted according to the actual soil amendments installed on the project. The contractor is to include the following soil amendments as part of the bid:

   a. Lawn Areas:
      1) Gypsum (100% purity) (Preplant), (4 tons per acre) or use pelletized gypsum in renovated turf areas.
      2) Soil Sulfur (100% purity) (Preplant), (1/2 ton per acre) or use Tiger 90CR soil sulfur in renovated turf areas.
      3) Best Triple Pro Fertilizer (Preplant) - (15-15-15), (500 lbs per acre).
      4) Best Preplant Fertilizer (Preplant) - (6-24-24 XB), (500 lbs per acre).
      5) Global Premium Humate (Preplant), (250 lbs per acre).
      6) Best All Season Fertilizer with Polyon 43 (Maintenance) - (19-6-12), maintenance applications and rates as follows:

         Hydroseeded Turf Areas: (130 lbs per acre) per maintenance application. Minimum of seven (7) maintenance applications required for bid. Fertilize hydroseeded areas every other week as noted. Actual application will conform to soil test results.

         Sodded Turf Areas: (200 lbs per acre) per maintenance application. Minimum of three maintenance applications required for bid. Fertilize sodded areas monthly. Actual application will conform to soil test results.

      7) Pelletized Gypsum, (Maintenance) - (1 tons per acre). One maintenance application required for bid. Actual application will conform to soil test results.
      8) Global Premium Humate, (Maintenance) - (250 lbs per acre). One maintenance application required for bid. Actual application will conform to soil test results.

   b. Planter Areas:
      1) Nitrified Aged Fir Humus (forest product) (Preplant), (4 cu. yds. per 1000 sq.

ft.).

2) Gypsum (100% purity) (Preplant), (4 tons per acre).
3) Soil Sulfur (100% purity) (Preplant), (1/2 ton per acre).
4) Best Triple Pro Fertilizer (Preplant), (15-15-15), 500 lbs per acre.
5) Best Preplant Fertilizer (Preplant), (6-24-24 XB), (500 lbs per acre).
6) Global Premium Humate (Preplant), (250 lbs per acre).
7) Best All Season Fertilizer with Polyon 43 (Maintenance) - (19-6-12), maintenance applications and rates as follows:

   Planter Areas: (200 lbs per acre) per maintenance application. Minimum of three maintenance applications required for bid. Fertilize planter areas monthly. Actual application will conform to soil test results.

8) Pelletized Gypsum, (Maintenance) - (1 tons per acre). One maintenance application required for bid. Actual application will conform with soil test results.
9) Global Premium Humate, (Maintenance) - (250 lbs per acre). One maintenance application required for bid. Actual application will conform to soil test results.

The Owners authorized representative and Contractor shall negotiate the differences in costs according to the materials required based upon the recommendations of the soil testing laboratory. No labor difference in cost will be allowed for application of the corrected materials to be used.

3. Soil Amending – Application #1: If salt is present in the soil test results, Contractor is to apply and incorporate the following soil amendments into the soil – Gypsum, Soil Sulfur and Nitrified Aged Fir Humus (planter areas only). Contractor is to reestablish site grades (smooth areas without displacing amendments) and leach the soils for four to six weeks.

4. Contractor is to retest the site soils as noted in 1.12 (B) above, if salt is present in the soil test results and leaching is required.

5. Soil Amending – Application #2: Contractor is to apply and incorporate the following soil amendments into the soil – Preplant Fertilizers and Humate amendments. Contractor is to reestablish site grades (smooth areas without displacing amendments) and leach the soils for one to two weeks.

6. If there are no or low salts in the soil test reports and leaching is not required, then the Contractor can combine Preplant Soil Amendment Applications #1 & #2 and delete the leaching requirement and issue a credit to the District.

7. After cultivation, water the site until the first weed crop is established. Cultivate or treat with chemicals to assure a weed-free condition.

7. Planting beds may be established after the second cultivation and final fine grading has been inspected and approved.

B. Planting holes:

1. All 15 gallon size trees or larger, are to have one 18” diameter hole drilled up to ten (10’) deep to insure proper drainage. Holes are to be off set with tree root balls “benched” into the top of the hole to prevent the tree against settlement.
2. Holes are to be excavated three times the size of the rootball. The contractor is to slightly off-set the drainage holes to prevent settling of plants after installation. The contractor is to

guarantee that the trees and shrubs will not settle below grade. Trees in turf grass areas are to be planted after the hydroseed and sod has become established and no longer requires excessive irrigation, which may cause undue stress to the trees.

3. Holes are to be in damp (but not saturated) and friable condition with all hidden obstructions removed before planting. The backfill is to be mixed thoroughly as specified adjacent to the planting hole prior to planting.

C. Leaching: Leaching of the soils is a critical element in how fast the soils will be reclaimed. The Contractor is to expedite the irrigation installation during the early stages of the project to allow leaching operations with the irrigation system at the earliest possible time in the project schedule. The Contractor is to provide labor and materials as needed to leach soils with irrigation water in areas that will not delay the progress of other site improvements. During leaching operations, the Contractor is to maintain the soil saturated while limiting runoff. Contractor is to monitor depth of soil saturation to plan periods of drying appropriately.

Contractor is responsible for temporary measures required to retrofit the planter area irrigation system for leaching by installing spray nozzles on bubbler pop ups, installing temporary sprinklers, temporary lateral pipes or relocating sprinkler or other improvements required to insure good coverage of all planter areas for the purposes of leaching. Once leaching has been completed, contractor is to remove temporary improvements and restore the system to conform to the project documents.

3.4 PLANTING

A. Water plants immediately upon delivery to site. Maintain in moist condition until planted.

B. Space plants uniformly as shown on plans. The Contractor is to stake the locations of plants and tree locations prior to layout of irrigation system for review and approval by the Landscape Architect and District in the field prior to trenching. Contractor is to use color coded flags to stake trees and plant materials by variety. After the plant layout has been approved, the Contractor is to stake the bubbler locations for each plant and tree. Bubblers are to be located on the uphill side of the plant within the plant basin. Landscape Architect or District may move, add or delete plants or trees in the field and the Contractor is to adjust the work as required at no additional cost to the District. Contractor is not to proceed with irrigation or planting operations, until the planting locations have been approved by the Landscape Architect and District in the field.

C. Cut cans by cutting vertically on two opposite sides of can with can cutter, or as recommended by the nursery for the type and size of containers supplied with the plant materials. Do not damage plant.

D. Plant immediately after removal from the can or flat. Position the top of the plant root ball 1" above finish grade. Backfill as follows:

1. (85%) native soil.

2. (15%) nitrified humus.

3. Azaleas and camellias are to have an additional 2 cu. ft. Camellia Mix in backfill.

4. Agriform / Best plant tabs as indicated on plans. Place plant tabs beside root ball as recommended by the fertilizer manufacturer. Construct a watering well one foot radius from stem or trunk that will allow water to fill well at least 3" deep for shrubs and two foot radius from trunk that will allow water to fill well at least 4" deep for trees. Fill water well at least six times by hand after planting.

E. Fertilize all ground cover areas with post-plant commercial slow release fertilizer 19-6-12 upon completion of planting, and every 30 days through the first growing season at a rate of 5 lbs per 1000 square feet, or as recommended by the soil test results.

F. At completion of planting, all non-turf planted areas are to receive a three inch (3") compacted layer of organic topdressing mulch as designated on the Landscape Planting Plan. Wash excess bark or decomposed granite off leaves and do not engulf stems of trees, plants and ground cover.

G. Lawn Installation (Hydroseed):

1. The turf areas, as indicated on the plans, shall be hydroseeded in one operation after all trees, weed removal, soil preparation, grading, scalping, verticutting and irrigation system work have been completely installed, inspected and approved.

2. Hydromulch mixing shall be performed in a tank with a built-in continuous agitation and recirculation system of sufficient capacity to produce a homogeneous slurry of fiber, fertilizer, water, and additives in the specified proportion. Hydroseeding Slurry Mix:

   a. Mulch: Agrono-Mulch @ 1500 lbs per acre. As distributed by Agrono-Tec Seed Co., Fresno, California, (559) 277-2444.
   b. Binder: Agrono-Tac @ 120 lbs per acre.
      Fiber Plus @ 25 lbs per acre.
   c. Fertilizer: Soluble time release granular mixture of 24-4-8 @ 250 lbs per acre.
   d. Seed – Bermudagrass Turf: Pan Am Improved Seeded Bermudagrass (4 lbs per 1,000 sq ft) and Perennial Ryegrass (8 lbs per 1,000 sq ft) Blend. Seed at a rate of 12.0 lbs per 1,000 sq ft.

3. The final seed mix is subject to change. Verify the final approved seed mixes with the Owners authorized representative prior to seeding. The seed mix will be adjusted to account for the use, drought tolerance, and the time of year to be installed.

4. The area to be seeded shall be slightly moist after the last watering and final weeding operations. The grading must be approved prior to hydroseeding. The site must be free draining prior to hydroseeding.

5. The area to be seeded shall be hydromulched with a discharge system that will apply the slurry to the areas to be treated at a continuous, uniform rate. The tank shall have a minimum capacity of 1000 gallons. Nozzle applying the slurry shall be held close enough to the areas to be planted to distribute the slurry in a uniform coating on the surface. A green marker dye shall be used to show such coverage.

6. The allowable planting window for hydroseed starts on April 15th and extends thru July 30th annually. Planting after July 30th or before April 1st requires written permission of the District and seed mix may be changed at no additional cost to the project. Do not plant in excessively hot weather or when unseasonably hot weather is forecast soon.

7. The turf area establishment work is to proceed as follows. Time periods noted are from the date of hydroseed planting.

   a. *Weeks 1 thru 4:* Fertilize once (week 3 or week 4) with Best 19-6-12 with polyon 43 at a rate of 3.0 lbs per 1,000 sq ft (130 lbs per acre) to keep hydroseed in a healthy growth state and mow once (week 4) with reel mower with roller (Toro 5210, or approved equal) to stimulate the lateral turf growth and increase density.
   b. *Weeks 5 thru 15:* Fertilize every other week (weeks 6, 8, 10, 12 & 14) with Best 19-6-12 with polyon 43 at a rate of 3.0 lbs per 1,000 sq ft (130 lbs per acre). Mow 2

times weekly with reel mower with roller (Toro 5210, or approved equal) to stimulate the lateral turf growth and increase density. Mowing height to be 5/8" to 3/4" of an inch.

c. *Weeks 16 thru 17:* Fertilize as required to keep turfgrass in a healthy condition. Mow 1-2 times weekly with reel mower with roller (Toro 5210, or approved equal) and raise turfgrass mowing height to 1" to complete the maintenance period.

8. A minimum of one trained workman shall be on the site 2 hrs per day (minimum or as required) after hydroseeding and through the maintenance period. The hydroseeded areas shall be watered immediately and kept damp during the entire germination period. Areas that are drying out too soon due to wind or other causes shall be watered by hand until the whole grass area comes up in a uniform and even covering of grass. Care shall be used to not overwater, which would create erosion. All erosion scars are to be repaired the same day.

9. The contractor is to carefully observe the newly planted grass to keep moist and in a healthy growing condition. The contractor is to water and fertilize as needed to keep the turf in a vigorous healthy condition.

10. The contractor is to protect the newly seeded area from foot traffic as needed. The contractor is to continuously reseed and repair damaged areas. The turf areas, as indicated on the plans, shall be hydroseeded in one operation after all weed removal, soil preparation, grading and irrigation system have been completely installed and approved. Trees are to be installed after the turf has been established. Stake tree locations during turf establishment.

H. Lawn Installation (Sod):

1. The turf areas, as indicated on the plans, shall be sodded (use big roll sod in larger areas) in one operation after all weed removal, soil preparation, grading and irrigation system have been completely installed and approved. Trees are to be installed after the turf has been established. Stake tree locations during turf establishment.
2. The allowable planting window for sod starts on April 1st and extends thru July 30th annually. Planting after July 30th or before April 1st is not permitted without written permission. Contractor is to schedule the work to insure that the planting is completed within this planting window. Do not plant in excessively hot weather or when unseasonably hot weather is forecast in the near future.
3. Finish grade is to be smooth and firm to prevent differential settlement. Sod is to be laid in staggered rows (brick like pattern). Edges are to be firmly butted together to insure soil to soil contact between sod pieces. Sodded areas are to be rolled (water roller) to remove air pockets and insure good soil contact.
4. The area to be sodded shall be slightly moist after the last watering and final weeding operations. The grading must be approved prior to sodding. The site must be free draining prior to sodding.
5. The turf area establishment work is to proceed as follows. Time periods noted are from the date of sod planting.

   a. *Weeks 1 thru 4:* Fertilize once (week 2 or week 3) with Best 19-6-12 with polyon 43 at a rate of 4.6 lbs per 1,000 sq ft (200 lbs per acre) to keep sod in a healthy growth state and mow once per week.
   b. *Weeks 5 thru 12:* Fertilize twice (weeks 7 & 12) with Best 19-6-12 with polyon 43 at a rate of 4.6 lbs per 1,000 sq ft (200 lbs per acre). Mow 1 time weekly. Mowing height to be 3/4" to 1" inches.
   c. *Weeks 13 thru 17:* Fertilize once (week 16 or week 17) to keep turfgrass in a healthy condition. Mow 1 time weekly and raise turfgrass mowing height to 1" to complete the maintenance period.

6. A minimum of one trained workman shall be on the site 8 hrs per day after sodding and through the maintenance period. The sodded areas shall be watered immediately and kept damp during the entire establishment period. Areas that are drying out too soon due to wind or other causes shall be watered by hand until the whole grass area is established in a uniform manner. Care shall be used to not overwater, which would create erosion and fungus. All erosion scars are to be repaired the same day.
7. The contractor is to carefully observe the newly planted grass to keep moist and in a healthy growing condition. The contractor is to water and fertilize as needed to keep the turf in a vigorous healthy condition.
8. The contractor is to protect the newly sodded area from foot traffic as needed. The contractor is to continuously resod and repair damaged areas as required.

3.5 STAKING AND TYING

A. Remove nursery stakes and ties.

B. Install tree stakes 18" deep on windward and leeward sides of tree and tie to tree with 4 ties. Install ties loose enough to avoid injuring cambium layer of tree and to allow limited movement.

C. Remove nursery ties from shrubs and espaliered plants and install new plastic ties in a loose manner so new plant growth will not girdle the branch or stem.

3.6 MAINTENANCE

A. Maintain planted areas during the progress of the work and through the maintenance period. A minimum of one trained workman shall be on the site 8 hrs per day after planting the turfgrass until the fourth mowing and as needed through the maintenance period.

B. The maintenance period begins when the work is substantially completed and accepted by the Owner. The turf areas are to be completely planted and show active growth and reasonable coverage before the specified maintenance period can begin. The maintenance period shall be for one hundred twenty days (120) days, after substantial completion by the Owner. The Owner and Landscape Architect shall be notified a minimum of 10 days prior to the time that the work is ready for final inspection. This final inspection is required before the maintenance period can begin. The contractor is responsible to provide all materials and labor to maintain the site for the maintenance period at no cost to the Owner. The maintenance period may be extended at no cost to the Owner should prevailing site conditions not warrant final acceptance by the Owner. The site should be in a weed free condition, the lawns should be established, vigorous, have minimum 99% coverage, be weed free, and fertilized, and all plants and trees are to be in good condition. The maintenance period will be extended in one month increments until the Contractor brings the site into compliance at no additional cost to the Owner.

C. During the maintenance period the contractor shall provide the following services, but is not limited to the services outlined below.

1. Maintain surfaces and supply additional top soil where necessary, including areas affected by erosion.

2. Water to ensure uniform hydroseed and sod growth and to keep surface of soil damp. Fertilize as specified on a monthly, or as needed basis.

3. Apply water slowly so that surface of soil will not puddle and crust.

4. Maintain turf & planted areas weed free. Hand weed or use chemicals at the Contractor's option.

5. Mow and maintain the turf areas, and pick up grass clippings to be hauled off site at the Contractors expense.

3.7 CLEAN-UP

A. Remove rubbish, trash, and debris resulting from the operation at the end of each working day.

B. Wash paved surfaces clean.

C. Maintenance period will begin with acceptance of installation by the Owner and will continue as noted in article 3.06.

3.8 EXTRA LANDSCAPE MATERIALS

A. Contractor shall supply the following extra materials to be installed at the direction of the Landscape Architect during the project at any time. Each item is to include all associated materials (landscape and irrigation) and all appurtenances associated with the item, including material, labor and equipment costs for a complete installation in accordance with the project documents at no additional cost to the Owner. Should any items not be installed as part of the project, the remaining items are to be delivered to Owner or a credit issued at the Owner's option as part of the project completion documentation.

1. Five (5): One gallon size plants (Planting Plan varieties)
2. Five (5): Five gallon size plants (Planting Plan varieties)
3. Three (3): Fifteen gallon size trees (Planting Plan varieties)

All work is to be in compliance with all project specifications and construction details at no additional cost to the Owner.

-- END OF SECTION --

SECTION 331200
WATER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:
   1. Pipe and fittings for on-site domestic piping.
   2. Valves and valve boxes.
   3. Accessories.

B. RELATED SECTIONS
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 311100 - Site Clearing
   3. Section 312000 - Earthwork: Excavation, Filling and Grading
   4. Section 312222 - Soil Materials
   5. Section 312333 - Trench Excavation and Backfill
   6. Section 321313 - Site Concrete Improvements

1.3 REFERENCES

A. ASTM Test Method D1557 - Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18-inch (457 mm) Drop.

B. ANSI/ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

C. ANSI/AWWA C110 - Ductile Iron and Grey-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.

D. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

E. ANSI/AWWA C500 - Gate Valves, 3-inch through 48-inch NPS, for Water and Sewage Systems.

F. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water.

G. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and Class 200.

H. ASTM D2855 - Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.

I. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section SUBMITTALS and the Contract General Conditions.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Contract General Conditions and Division 1 Specifications.

B. Accurately record actual locations of piping mains, valves, connections and appurtenances, referenced to permanent surface features.

C. Identify and describe discovery of uncharted utilities or utilities found at locations different than indicated on plans.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with product manufacturer's recommendations and these Contract Documents.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle all products required.

PART 2 - PRODUCTS

2.1 WATER PIPE

A. Ductile Iron Pipe (for iron pipe larger than 3 inches in diameter, above ground): ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, thickness Class 50, with cement - mortar lining and seal coating per ANSI/AWWA C104/A21.4.
   1. Fittings: ANSI/AWWA C110/A21.10, ductile iron.
   2. Joints: Flanged.

B. PVC Pipe (for pipe 3 inches and smaller, underground): ASTM D1785, Schedule 40.
   1. Fittings: ASTM D 2464, Schedule 80 PVC (ASTM D 2466, Schedule 40 PVC for pipes 1-1/2 inches and smaller).
   2. Joints: ASTM D 2855, solvent weld.

C. PVC Pipe (for pipe 4 inches and larger, underground): ANSI/AWWA C900 Class 305.

1. Fittings: ANSI/AWWA C111, ductile iron.
2. Joints: ASTM D 3139 compression gasket ring.

D. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed “CAUTION - WATER LINE BELOW”.

2.2 VALVES - UP TO 2 INCHES (50 MM)

A. Use full port ball valves for 2 inches and smaller and resilient wedge gate valves for 2-1/2 inches and larger size.

B. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends.

2.3 GATE VALVES - 2-1/2 INCHES (63 MM) AND OVER

A. ANSI/AWWA C509, Iron body, bronze trim, non-rising stem with square nut or control handle wheel, resilient single wedge, threaded or flanged.

2.4 VALVE BOXES

A. Precast concrete with cast iron lid marked for service. Christy No. G5 or approved equal.

B. Valve boxes shall have a minimum 6 inch wide by 4 inch (6” inches in vehicular areas) thick concrete collar.

2.5 ACCESSORIES

A. Concrete for Thrust Blocks and Valve Box Surface Collars: Concrete type specified in Specification Section SITE CONCRETE IMPROVEMENTS.

B. Valve Boxes and Covers: Christy No. G5 traffic box, or approved equal. Cover marking shall read "Water". A one-piece PVC riser extension shall be provided as necessary to allow unobstructed access to valve operating nut.

C. Solvent Cement and Primer for PVC Pipe and Fittings: Per ASTM F656 and ASTM D2564.

D. Non-Firming Anticorrosion Wrap: Trenton Wax-Tape #1 or approved equal for application on belowground metal surfaces, pipe, or fittings in corrosive soils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions. All plot dimensions are approximate. Before proceeding with any work, carefully check and verify all dimensions and report any variations to the Engineer.

B. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. Carefully investigate the structural and finished conditions affecting all work, and plan work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Unless dimensions are shown, drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between water systems, planting, and architectural features will be minimized.

C. Do not install the facilities as indicated on the drawings when it is obvious in the field that unknown obstructions might not have been considered in the engineering. Such obstructions or differences should be brought to the attention of the Engineer before proceeding.

3.2 PREPARATION

A. Prepare for pipe installation by assembling all needed materials.

B. Cover all PVC pipe during storage.

3.3 BEDDING

A. Excavate trench, pit or hole in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL.

B. Where trench or pit has been overexcavated, place bedding material at bottom of excavations, level soil materials in continuous layers not exceeding 8-inches loose uncompacted depth.

C. Backfill around sides and to a level 12-inches above the top of pipe with bedding sand, tamped in place.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE AND FITTINGS

A. Install pipe at locations and depths indicated on plans.

B. Install pipe, fittings, and associated materials in accordance with manufacturer’s recommendations.

C. Route pipe in straight line, whenever possible. All changes in direction of pipes shall be made with fittings, not by bending.

D. Install pipe to allow for expansion and contraction without stressing pipe or joints.

E. Form and place concrete for thrust blocks at each elbow, tee, angle or other significant change of direction in loose-joint pipe, per detail on plans.

F. Establish elevations of buried piping to ensure not less than 30-inches of cover, except at connections to existing lines, which may be shallower or deeper, or where shown otherwise on plans.

G. When two water pipes are to be installed in same trench, maintain a minimum 4-inch horizontal clearance between pipes.

H. Backfill trench or other excavation in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL.

3.5 INSTALLATION - VALVES

A. Set valves on solid bearing.

B. Where valves are installed below finish surface grade, center and plumb valve box and any necessary extensions over valve. Set box cover flush with finished grade.

C. Pour concrete collar around top of valve box per detail on plans.

D. Furnish and install valves and valve boxes in addition to those shown on plans as required for isolation of lines for construction and disinfection, while minimizing disruption of service to buildings, at no additional cost to the Owner.

3.6 INSTALLATION - THREADED CONNECTIONS

A. Assemble all plastic and galvanized steel threaded pipe and fittings using an approved Teflon tape applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved Teflon tape will be required.

B. At all plastic (PVC) pipe connections, work the ductile iron connections first. Connections shall always be plastic into steel, never steel into plastic.

C. A non-hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe sealant may be used in lieu of Teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

3.7 PRESSURE TESTING OF SITE WATER PIPING SYSTEM

A. General: Unless otherwise directed, tests shall be witnessed by Inspector. Work to be concealed shall not be covered until prescribed tests are made. Should any work be covered before such tests, the Contractor shall, at his expense, uncover, test and repair his work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.

B. Water Piping: Pressure test all onsite water piping systems in accordance with AWWA Standard C605, “Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings”. The pressure testing process shall be performed in cooperation with the authority having jurisdiction and witnessed by the Owner’s Inspector. The constructor shall supply an affidavit of compliance to the Owner as required by AWWA Standard 605. Maintain 150 PSIG water pressure for a duration of four (4) hours. There shall be no drop in pressure during test except that due to ambient temperature changes. Flush all lines prior to pressure test.

C. Backflow Preventer: All backflow preventers shall be tested according to manufacturer’s recommendations and the USC Cross Connection Control and Hydraulic Research Manual latest edition and per local AHJ requirements. Testing shall be performed by an AWWA Certified Backflow Prevention Assembly Tester. Contractor shall provide written certification to the Architect sowing the date in which the backflow preventers were tested and confirmation that unit passed all test requirements.

3.8 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect all domestic water piping systems in accordance with AWWA Standard C651, "Disinfecting Water Mains", and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by the Owner’s Inspector. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner by the Owner’s Inspector.

3.9 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of the Contract General Conditions and Division 1 Specifications.

B. Compaction testing of bedding and backfill will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest. Any retests required due to failure of initial tests shall be paid for by the Contractor.

END OF SECTION

SECTION 333000
SITE SEWER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This Section includes the following:

1. Sanitary Sewer Pipelines and Fittings.
2. Accessories.

B. RELATED SECTIONS

1. Contract General Conditions and Division 1, General Requirements.
2. Section 311100 - Site Clearing
3. Section 312000 - Earthwork: Excavation, Filling and Grading
4. Section 312222 - Soil Materials
5. Section 312333 - Trench Excavation and Backfill
6. Section 321313 - Site Concrete Improvements

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. Safety Regulations: Work shall comply with all Federal, State and Municipal regulations regarding safety, including the requirements of the following:

a. William-Steiger Occupational Safety & Health Act of 1970.
b. State of California, California Administrative Code, Title 8 Industrial Relations, Chapter 4, Subchapter 4, "Construction of Safety Orders" and other State and local agencies having jurisdiction.
c. All trenching work shall conform to Trench Construction Safety Orders of California State Industrial Accident Commission.

1.4 REFERENCES

A. American Water Works Association (AWWA).

B. American Society for Testing and Materials (ASTM):
1. Designation D3034 - Polyvinyl Chloride (PVC) pipe.

C. California Plumbing Code, Latest Edition (CPC).

D. Local County Health Department Standards.

1.5 SUBMITTALS

A. Submit under provisions of Specification Section - SUBMITTAL PROCEDURES. Certificates of compliance for material

B. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.

C. Submit manufacturer's data and/or fabrication drawings for Sanitary Sewer Pipelines, Sanitary Sewer Manholes and Sanitary Sewer Fittings, installed under this Section. No items shall be incorporated into the work until submittals are approved by the Engineer.

1.6 COORDINATION

A. Verify location of existing utilities have been indicated at by local utility authorities.

1.7 EXISTING UTILITIES

A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

B. Service laterals and appurtenances have also been shown where information was available as to their location. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. At new work location, expose by hand methods all existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated at the work site by local utility authorities.

D. Maintain all existing utility mains and service lines in constant service during construction of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sanitary sewer pipelines for pipes 4 inches and larger shall be polyvinyl chloride (PVC) pipe conforming to ASTM Designation 3034, SDR-35, with elastomeric gasket joints per ASTM D 3212 and F477.

B. Sanitary sewer pipelines for pipe less than 4 inches shall be Schedule 40 PVC pipe, ASTM D1785.

C. All sanitary sewer fittings shall be watertight connections using PVC sewer fittings as approved by the California Plumbing Code, or approved equal to be determined by the Civil Engineer.

D. Surface cleanout shall be precast concrete with cast iron lid marked for service Christy G5 or approved equal and constructed as per detail drawing and current plumbing code.

E. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed “CAUTION - SEWER LINE BELOW”.

PART 3 - EXECUTION

3.1 CLEARING OF WORK SITE FOR SITE IMPROVEMENTS

A. Clear site for improvements per construction drawing demolition plan and in accordance with Specification Section SITE CLEARING.

3.2 TRENCH EXCAVATION

A. Trench excavation and backfilling shall be in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL and construction drawing detail.

B. Excavate trench to depth which is 6 inches below the outside bottom of the pipe barrel to be placed therein.

3.3 PIPE BEDDING MATERIAL

A. Excavated materials and imported materials shall meet engineering recommendations in accordance with Specification Section SOIL MATERIALS.

B. Bed pipe in sandfill and compact to a minimum of 90% maximum dry density. Place and compact the bedding material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench (6 inches below the outside bottom of the pipe barrel) to a level 12 inches above the outside top of the pipe barrel

3.4 PIPE INSTALLATION

A. Pipe Laying: Alignment and elevation stakes shall be set at intervals with offsets and cut to the invert of the pipe.

1. Proper facilities shall be provided for stringing and lowering sections of pipe into the trench. The pipe shall be laid carefully to lines and grades given.

2. The grade line shown on the plans indicates the flow line or invert of the pipe and all cuts, unless otherwise indicated, refer to this line.
3. After the trench for pipe has been brought to the proper line and grade, the pipe shall be laid in the following manner.

    a. Pipe laying shall proceed upgrade with the bell ends of bell and spigot pipe placed upstream. Each section of pipe shall be laid to line and grade as herein specified and in such a manner as to form a watertight, concentric joint with the adjoining pipe. The interior of the pipe shall be cleared of all dirt and debris and excess joint sealing material as the work progresses. Pipe shall not be laid when the condition of the trench or weather is unsuitable. All open ends of pipe and fittings shall be adequately and securely closed whenever the work is discontinued for more than one-half hour. If pipe with elliptical or quadrant reinforcement is used, care shall be taken to properly orient the axis.

4. All joint surfaces shall be cleaned before joints are made.
5. The Contractor shall furnish and use, for grade and alignment control, a laser beam system which complies with OSHA requirements. The laser system shall have good visibility when used with suitable target material. The laser system must be of the self-leveling type so that the laser beam is automatically compensated for minute grade disturbances.
6. The laser system must also have an early warning system that instantly warns the pipe layer when the laser is off grade. The laser system is to be provided by the Contractor and shall have a minimum accuracy of ±0.01 foot per one hundred feet (100') on line; and a minimum visible range of one thousand feet (1000'). When conditions are such that this method is impractical, such as on short pipe runs, the Contractor shall have an Engineer on the ground to set grade of each joint of pipe by means of an Engineer's level.

B. Sewer Systems Plugs: Temporary plugs of brick or mortar shall be installed on all sewer projects at points of connection to existing facilities. These plugs shall remain in place until completion of the balling and flushing operation. The plugs, intended to prevent water from the balling and flushing operation, drainage, or any other condition from entering the existing system, shall be installed or removed in the presence of and under the direct supervision of the Engineer. Until the system has been pumped clear of accumulated water, the plugs shall not be removed. This water must not be allowed to enter adjacent sewer or drainage systems.

C. Internal Inspection: Upon completion of construction and prior to final inspection, the Contractor shall clean the entire new pipeline of all dirt and debris. Any dirt or debris in previously existing pipes or ditches in the area, which in the opinion of the Engineer resulted from the new installation, shall also be removed by the Contractor. Sewer pipes shall be cleaned by the controlled balling method. Temporary plugs shall be installed and maintained during cleaning operations at points of connection to existing facilities to prevent water, dirt, and debris from entering the existing facility. Temporary plugs for sewer systems shall also conform to Subsection B, above. Water from the drainage system operations shall be routed through a suitable trap to collect any dirt and debris prior to discharging into any downstream facility. The Contractor shall notify the Architect immediately after completion of the pipe cleaning operations. Cleaning of drainage pipes by the controlled balling method will not be required.

D. As soon as possible after the completion of the pipe cleaning, and prior to final acceptance, the Architect or Engineer may make a visual internal inspection of the new pipeline either manually or with television equipment.

3.5 COORDINATION

A. Coordinate with the campus for the shutdown of the existing sewer system to make new sewer connection. Install sewer pipelines before making tie-in to the existing sewer pipeline. Tie-in work may proceed during the campus non-use of the existing sewer system such as on weekends.

3.6 TESTING OF SANITARY SEWERS

A. After cleaning per Section 3.4-C, each section of sewer constructed shall be tested in accordance with acceptable "Low Pressure Air Test for Sanitary Sewers" methods such as presented in the Journal of Sanitary Engineering, Division ASCE, April 1964, to test the point of effluent disposal. All lines and components shall be leak proof.

3.7 INSPECTION OF SANITARY SEWERS

A. System components shall be properly identified as to the manufacturer.

3.8 CLEAN-UP

A. Remove from the site all rubbish, debris, etc. in a lawful manner, resulting from work in this Section. The clean-up shall include the replacement and repair of any damaged or disturbed property.

END OF SECTION

SECTION 334000
STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

A. This section includes the following:
   1. Provide all materials, labor, equipment and services necessary to furnish and install Storm Drainage System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

B. RELATED SECTIONS:
   1. Contract General Conditions and Division 1, General Requirements.
   2. Section 312222 – Soil Materials
   3. Section 312333 – Trench Excavation and Backfilling
   4. Section 321313 – Site Concrete Improvements

1.3 REFERENCES

A. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

B. ANSI/ASTM C443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

C. ANSI/ASTM C478 Precast Reinforced Concrete Manhole Sections.

D. ASTM D1557

1.4 DEFINITIONS

A. Bedding: Fill placed under, around, beside and directly over pipe, prior to subsequent backfill operations.

B. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

A. Submit under provisions of Division 01.

B. Certificates of compliance for material.

C. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.

D. Submit manufacturer's data and/or fabrication drawings for all pipes, and appurtenances installed under this Section. No items shall be incorporated into the work until submittals are approved by the Architect/Engineer

1.6 COORDINATION

A. Coordinate work with Owner’s personnel.

B. Verify that the location of existing utilities have been indicated at work site by utility authorities and Owner’s personnel.

C. Coordinate work with other project work.

1.7 EXISTING UTILITIES

A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

B. Service laterals and appurtenances have also been shown where information was available as to their location. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. At new work location, expose by hand methods all existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated at the work site by Owner’s personnel.

D. Maintain all existing utility mains and service lines in constant service during construction of the Work

1.8 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Accurately record actual locations of utilities encountered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforced Concrete Pipe for pipe larger than fifteen (15) inches: ANSI/ASTM C76, Class 3, with rubber gasket joints per ANSI/ASTM C443.

B. Storm drainage sewer pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM designation 3034, SDR 35, with elastomeric gasket joints per ASTM D 3212 for pipe fifteen (15) inches or less.

C. Storm drainage pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM D1785, Schedule 40, for pipe three (3) inches or less.

D. Poured in Place Concrete: Specification Section SITE CONCRETE IMPROVEMENTS.

E. Mortar: Composed of one part, by weight, portland cement (Type II low alkali per ASTM C150), 2 parts, by weight, sand, and water.

F. Manhole Frames, Covers and Grates: Cast Iron per ASTM A48, Class 25.

G. Soil Fill for Concrete Pipe Bedding Envelope: Specification Section TRENCH EXCAVATION AND BACKFILL.

H. Catch basins and drain inlets shall be constructed as per detail drawing.

I. Concrete collar shall be constructed as per detail drawing.

J. Cleanout shall be precast concrete with cast iron lid marked for service Christy G5 or approved equal and constructed as per detail drawing.

K. All metallic pipe, fittings and appurtenances in contact with soil shall be coated or wrapped with an approved material, as required to protect it from corrosive soil.

L. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed “CAUTION – STORM SEWER LINE BELOW”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

3.2 PREPARATION

A. Identify location of proposed storm drainage facilities to be constructed. Expose connection points to existing system.

B. Locate, identify, and protect existing above and below grade utilities from damage.

C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

D. Protect existing structures and other improvements to remain from damage from excavation equipment and vehicular traffic.

E. Employ equipment and methods appropriate to the work site.

F. Protect excavated areas from drainage inflow, and provide drainage to all excavated areas. Dewater existing drainage basins and existing drainage pipeline systems as necessary to accomplish the work.

G. Comply with safety requirements as they pertain to excavations, per Specification Section EARTHWORK.

H. Remove all interfering surface and subsurface improvements authorized for removal.

3.3 EXCAVATION

A. Excavate soil required to locate existing utilities and install the work.

B. Excavate trenches and pits per Specification Section EARTHWORK.

C. Excavate trenches and pits to allow installation and construction of the storm drainage facilities to the alignment, grades, depths and cross-sections as indicated on the construction plans.

D. Excavate trench to depth which is 6 inches below the outside bottom of the pipe barrel to be placed therein.

E. Cut trenches just wide enough to allow the installation of the pipe and pipe bedding as indicated on the plans. Minimize trench width above the pipe.

F. Provide protection to public per Division 01.

3.4 INSTALLATION AND BEDDING OF STORM DRAIN PIPE

A. Install the pipe and fittings to the lines and grades shown on the construction plans.

B. Install pipe and fittings in accordance with the manufacturer's recommendations, and these specifications.

C. Unless otherwise approved by the Engineer, lay all pipe upgrade from structure to structure, with bell or socket ends of pipe upgrade.

D. Excavate suitable bell (or socket) holes in the bedding material, so that the bells do not bear on the subgrade or bedding. Provide uniform bearing of pipe barrel on bedding material.

E. Ensure that all joints are properly "homed" and are watertight.

F. Bed pipe in sandfill and compact to a minimum of 90% maximum dry density. Place and compact the bedding material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench (6 inches below the outside bottom of the pipe barrel) to a level 12 inches above the outside top of the pipe barrel.

3.5 INSTALLATION OF STORM DRAINAGE STRUCTURES AND APPURTANCANCES

A. Install storm drainage structures as indicated on the construction plans, in accordance with the manufacturer's recommendations, and as specified herein.

B. Construct poured-in-place concrete per Specification Section SITE CONCRETE IMPROVEMENTS.

C. Key top of poured-in-place concrete bases for structures to receive the tongue of precast riser sections.

D. Construct cleanout, outfall structure per detail drawing.

3.6 BACKFILLING TO FINISHED GRADE AND FINISHED GRADING

A. Place and compact backfill per Specification Section TRENCH EXCAVATION AND BACKFILL.

B. Conform finished surface to the lines, grades and cross-sections shown on the plans, or as otherwise directed by the Inspector.

C. In areas to receive paving or a significant thickness of sealing material, temporarily set manhole frame and cover below finish grade, then return after final surfacing and/or pavement sealing and bring manhole frame and cover to final grade, as shown on the plans.

D. Fine grade all finished soil surfaces disturbed to the lines, grades and cross-sections shown on the plans.

E. Rake and smooth all finished dirt surfaces.

3.7 TOLERANCES

A. Pipe laying tolerances:

1. Above grade: Not to exceed 1/4-inch above planned grade.
2. Below grade: Not to exceed 1/2-inch below planned grade.
3. Alignment: Not to exceed 2 inches from planned alignment, if gradual and regular over a distance of 20 feet.

B. Structure finish grade tolerance: Within 1/4 inch of planned grade, but must match adjacent improvements.

3.8 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01.

B. Compaction testing of bedding and backfill will be performed in accordance with ASTM D 1557.

C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest at no additional cost to Owner.

END OF SECTION

SECTION 441113
FUGITIVE DUST CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section This Section includes the following:

1.2 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, fees, and services necessary to comply with the San Joaquin Valley Air Pollution Control District (SJVAPCD) Regulation VIII for dust control requirements.
   2. Contractor will determine the total disturbed surface area and the estimated bulk material moving volumes anticipated for the Project to determine if a Construction Notification or Dust Control Plan is required. Contractor shall prepare and submit a Construction Notification or Dust Control Plan to the SJVAPCD based on these expected Project conditions/activities.
   3. Non-residential Projects that will include five acres or more of disturbed surface area and/or will be moving, depositing, or relocating more than 2,500 cubic yards of bulk material on at least three days of the project are required to submit a Dust Control Plan to the SJVAPCD and receive approval prior to commencing earth moving activities.
   4. Non-residential projects that will include less five acres of disturbed surface area must submit a Contruction Notification at least 48 hours prior to commencement of any earthmoving activities. No approval or response from the SJVAPCD is required.
   5. Contractor shall be solely responsible for payment of any fees or fines related to violations of SJVAPCD Regulation VIII from Project activities/conditions.
   6. All Contract requirements in Division 00 and 01 specefications.

B. Acronyms:
   1. SJVAPCD San Joaquin Valley Air Pollution Control District

1.3 RELATED SECTIONS

A. Contract General Conditions and Division 1, General Requirements
B. Section 31 11 00 – Site Clearing
C. Section 31 20 00 – Earthwork
D. Section 33 41 00 – Storm Drainage

1.4 REFERENCES

A. SJVAPCD Compliance Assistance Web Page on Dust Control:
   1. https://ww2.valleyair.org/compliance/dust-control/

B. SJVAPCD Regulation VIII
   1. https://ww2.valleyair.org/rules-and-planning/current-district-rules-and-regulations/regulation-viii-fugitive-pm10-prohibitions/

1.5 SUBMITTALS

A. If applicable, Contractor shall submit to the SJVAPCD the Project Dust Control Plan at least 30 days prior to commencing earth moving activities.

B. If applicable, Contractor shall submit to the SJVAPCD the Project Construction Notification at least 48 hours prior to commencing earth moving activities.

C. Contractor shall submit to Owner the Project Dust Control Plan approved by the SJVAPCD or documentation of submission of a Construction Notification to SJVAPCD prior to commencing earth moving activities.

1.6 REQUIREMENTS

A. Comply with all requirements of SJVAPCD Regulation VIII throughout the life of this contract.

B. The Contractor shall be fully aware of the requirements of SJVAPCD Regulation VIII, the requirements of these specifications for preparing, implementing, maintaining, and enforcing the provisions of SJVAPCD Regulation VIII, and the impact that Regulation VIII will have on the operation, prosecution and cost of the work. A submittal of a bid on this project will be considered as prima facie evidence that the Contractor fully comprehends these requirements and impacts and has fully allowed for their effect on this project, both in time and cost. Failure to comply with SJVAPCD Regulation VIII is a violation of local regulations. Contractor hereby agrees to indemnify, defend and hold harmless Owner, its officers, agents, and employees from and against any and all claims, demands, losses or liabilities of any kind or nature which Owner, its officers, agents, and employees may sustain or incur for noncompliance with the Regulation VIII arising out of or in connection with the Project, except for liability resulting from the negligence or willful misconduct of Owner, its officers, agents or employees. Owner may seek damages from Contractor for delay in completing the Project in accordance herewith, including damage caused by Contractor's failure to comply with Regulation VIII requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Dust Management Practices (DMPs):
   1. The Contractor is responsible for the providing and furnishing all DMPs, products, and practices necessary to comply with Regulation VIII. All materials and DMPs shall follow the requirements outlined in Regulation VIII, Rule 8021.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Dust Control Training Class Certificate:
   1. At least one key individual representing the Contractor who prepares a Dust Control Plan must complete a Dust Control Training Class conducted by the SJVAPCD.
   2. At least one key individual representing the Contractor who is tasked to implement the Dust Control Plan must complete a Dust Control Training Class conducted by the SJVAPCD.

3.2 CLEANING AND REMOVAL

A. All temporary DMPs shall be completely removed from the Project Site upon completion of construction.

3.3 RECORD KEEPING

A. If a Dust Control Plan applies to the Project, Contrator shall maintain records in accordance with the recordkeeping requirements of Regulation VIII, Rule 8011.

3.4 PAYMENT

A. Full compensation for all costs involved in preparing, submitting, implementing, and monitoring the implementation of Regulation VIII for this project, including training, performing corrective measures, providing all labor, materials, resources to maintain the site, and all required records for a Dust Control Plan (if applicable), and being full liable for all failures to fulfill the intent and requirements of the Regulation VIII set forth by the SJVAPCD, shall be included in the cost bid for the various items of work and no additional payment will be made therefor.

END OF SECTION

SECTION 481400
SOLAR ENERGY ELECTRIC POWER GENERATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install the complete solar energy electric power generation system.

1.2 REFERENCES

A. The solar photovoltaic system and overcurrent protection devices referenced herein shall be designed and manufactured according to the following appropriate specifications.

1. 2022 California Electrical Code (CEC)
2. California Public Utilities Commission Rule 21 Interconnection
3. UL 1741 and UL 1741-SA
4. UL 62109-1
5. UL 1703
6. UL 489 - Molded Case Circuit Breakers

1.3 SUBMITTALS

A. Submittals for this Section shall be made according to the Conditions of the Contract, Division 01 Specification Sections and Specification Section 260100.

B. Shop Drawings

1. Submit Shop Drawings for the complete solar energy electric power generation system including all equipment solar photovoltaic modules and inverters, supports and anchorage, cabling and connectors elevations with overall dimensions, conduit entrance locations and requirements, nameplate legends, one-line diagrams, equipment schedule, switchboard instrument details and labeling details.

C. Test Reports

1. Record the solar PV energy production for 24-hours and submit a report indicating power produced (kW) and energy produced (kWh) during each 15-minute increment over the 24-hour period. Provide a general statement of the weather conditions with high and low temperatures during the 24-hour period.

D. Operation and Maintenance Data

1. Submit operation and maintenance data for the solar energy electric power generation system to include in “Operations and Maintenance Instructions” manuals specified in Division 01 and Specification Section 260100 including detailed manufacturer’s written instructions on adjusting overcurrent protective devices.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

B. Inspect and report concealed damage to carrier within their required time period.

C. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect equipment from dirt, water, construction debris, and traffic.

D. Handle equipment carefully to avoid damage to equipment internal components, enclosure, and finish.

1.5 PROJECT CONDITIONS

A. Verify dimensions by field measurements.

B. Determine suitable path for moving switchboard into place considering project conditions.

C. Verify clearance requirements. Locate equipment to meet installation tolerances.

D. Revise locations and elevations from those indicated as required to suit project conditions.

1.6 WARRANTY

A. Manufacturer shall warrant equipment to be free from defects in materials and workmanship for the lesser of one (1) year from date of installation or eighteen (18) months from date of purchase.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This design is based on the use of equipment manufactured by Chint Power Systems North America and Panasonic, subject to compliance with project requirements.

2.2 SOLAR PHOTOVOLTAIC MODULES

A. Solar photovoltaic modules

1. Manufacturer: Panasonic
2. Model: Evervolt EVPV390H
3. Internal Bypass Diodes: 4 Bypass Diodes
4. Dimensions: 71.7”L x 40.0”W x 1.2”H
5. Weight: 45.0 lbs
6. Cable Length +Male/-Female: 43.3/47.2 inches
7. Cable Size / Type: No. 12 AWG / PV cable
8. Connector Type: Multi-Contact type IV [MC4]
9. Max Snow Load: 146PSF
10. Max Wind Load: 83.5PSF
11. Rated Power: 390W
12. Maximum Power Voltage: 41.5V
13. Maximum Power Current: 9.40A
14. Open Circuit Voltage: 48.6V
15. Short Circuit Current: 10.19A
16. Temperature Coefficients [Pmax]; [Voc]; [Isc]: -0.258%/deg C; -0.16V/deg C; 3.34mA/deg C
17. NOTC: 44.0deg C
18. CEC PTC Rating: 311.7W
19. Cell Efficiency: 22.09%
20. Module Efficiency: 19.7%
21. Watts per SF: 19.6W/sf
22. Maximum System Voltage: 1000V
23. Max Series Fuse Rating: 25A
24. Watt Class Sorting [+/-]: +10W / -0W

2.3 SOLAR PHOTOVOLTAIC INVERTERS

A. Solar photovoltaic inverters shall be commercial string inverters approved for wet location installation outdoors. Solar photovoltaic inverters shall be UL listed as PV rapid shut down equipment.

1. Manufacturer: Chint Power Systems North America
2. Model: CPS SCA60KTL-DO/US-480 with Rapid Shutdown
3. Dimensions: 23.6”W x 39.4”H x 10.24”D
4. Weight: 156.5 lbs
5. Enclosure: NEMA 4X with variable speed forced air cooling
6. Commonly used module pairings: 320W-460W
7. Module Compatibility: 96-cell PV modules
8. Maximum Input DC voltage: 1000 Vdc
9. Maximum PV Power: 90kW (33kW per MPPT)
10. Operating DC Input Voltage Range: 200-950Vdc
11. Start-up DC input voltage/power: 330V/80W
12. Max fault current contribution: 64.1A
13. Overvoltage class DC port: II
14. Nominal (L-L) voltage / range: 480Vac
15. Maximum continuous output current at 480Vac: 79.4A
16. Nominal Frequency: 60Hz
17. Extended Frequency Range: 57-63Hz
18. Power factor setting: >0.99 (+/-0.8 adjustable)
19. CEC weighted efficiency at 480VAC: 98.5%
20. User interface: LCD+LED
21. Inverter Monitoring: SunSpec, Modbus RS485
22. Site-level Monitoring: CPS FlexOM Gateway
23. Modbus Data Mapping: CPS
24. Remote Diagnostics / Firmware Upgrade: Standard / (with FlexOM Gateway)

2.4 SOLAR PHOTOVOLTAIC COMMUNICATION GATEWAY AND MONITORING SOFTWARE

A. The solar photovoltaic system shall be provided with the Chint Power Systems FlexOM communication gateway and SunSpec monitoring and analysis software including revenue grade production metering and consumption monitoring.

B. The solar photovoltaic monitoring software shall be web-based and make the solar energy production statistics accessible to the Owner through the internet for the life of the system at no additional cost.

2.5 SOLAR PHOTOVOLTAIC SYSTEM LABELING AND IDENTIFICATION

A. Plaque: Provide a permanent plaque identifying location of all electric power sources, complying with CEC Article 705.10.

B. Solar Photovoltaic Disconnecting Means: Provide a permanent marking at each solar photovoltaic disconnecting means complying with CEC Article 690.13(B).

C. System Rating: Provide a permanent label at the point of interconnection indicating the rated AC output current and the nominal operating voltage complying with CEC Article 690.54.

D. Rapid Shutdown: Provide a permanent label complying with CEC Article 690.56(C) for rapid shutdown.

E. Solar PV Circuits: Provide permanent labels to identify conduits, raceways, pullboxes associated with the solar PV system. Comply with CEC Article 690.31(D)(2).

F. DC PV Circuits: Provide a permanent readily visible label indicating the highest maximum DC voltage in the PV system. Comply with CEC Article 690.53.

G. Warning Labels: Provide permanent orange warning labels on all electrical solar PV distribution equipment and disconnecting means complying with CEC Articles 690.13(B) and 705.12

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine area to receive the solar photovoltaic system to provide adequate clearance for the solar photovoltaic system installation.

B. Check that concrete pads are level and free of irregularities.

C. Start work only after unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install the solar photovoltaic system in accordance with manufacturer's written guidelines, the CEC, and local codes.

B. Securely support and anchor solar photovoltaic modules to rooftop supports using S-5 clamps per manufacturer’s instructions and structural details provided by the metal building manufacturer.

C. Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

3.3 CONNECTIONS

A. Connect solar photovoltaic inverter and solar photovoltaic module system components to solar photovoltaic DC and AC cabling and wiring systems using appropriate system cable connectors as indicated and instructed by manufacturer.

B. Connect solar photovoltaic inverters, solar photovoltaic modules, and metal rack system components to ground as indicated and instructed by manufacturer.

C. Tighten electrical connectors and terminals, including screws and bolts, according to manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicates, use those specified in UL 786A and UL 486B.

3.4 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturer's specifications.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values as instructed by the Engineer.

3.5 SOLAR PHOTOVOLTAIC SYSTEM LABELING AND IDENTIFICATION

A. Plaque: Install a permanent plaque identifying location of all electric power sources, complying with CEC Article 705.10.

B. Solar Photovoltaic Disconnecting Means: Install a permanent marking at each solar photovoltaic disconnecting means complying with CEC Article 690.13(B).

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F. DC PV Circuits: Install a permanent readily visible label indicating the highest maximum DC voltage in the PV system. Comply with CEC Article 690.53.

G. Warning Labels: Install permanent orange warning labels on all electrical solar PV distribution equipment and disconnecting means complying with CEC Articles 690.13(B) and 705.12

3.6 CLEANING

A. Upon completion of installation, inspect solar PV installation for cleanliness. Rinse solar panels with clean water to clear away any loose dirt.

END OF SECTION 481400

SOILS ENGINEERING, INC.

GEOTECHNICAL INVESTIGATION

FOR THE

UNIVERSITY CENTER & STUDENT UNION BUILDINGS

615 S. MOONEY BLVD

VISALIA, TULARE COUNTY, CA

Prepared for:

College of the Sequoias
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By:

SOILS ENGINEERING, INC.
SEI File No. 24-19596
June 19, 2024

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GEOTECHNICAL INVESTIGATION

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INTRODUCTION

In accordance with your request, we have performed a Geotechnical Investigation at the subject site. Recommendations for site preparation and grading, and criteria for foundation design are provided in the attached report.

Appendix A, "Guide Specifications for Earthwork," is provided as a supplement to the section titled "Earthwork Recommendations" in the recommendations of the report.

Appendix B, "Field Investigation," contains the Boring Location Map as Figure 1, showing the approximate location the test bores, and the Logs of Test Borings, Figures 2 through 12.

Appendix C, "Soils Test Data," contains tabulations of laboratory test data.

Appendix D, “Geologic Hazard Study,” contains data from EQFault, LiquefyPro, and the USGS.

We hope this provides the information you require. If you have any questions regarding the contents of our report, or if we can be of further assistance, please contact us.

Respectfully submitted,
SOILS ENGINEERING, INC.

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SITE INFORMATION

A. SITE LOCATION AND CONDITIONS

The University Center & Student Union Buildings Project is located at 915 S. Mooney Blvd, Visalia, CA (Site). The proposed improvements for the project site at this time are to construct a University Center (2 story steel structure, +/-52,000 square feet), Student Union (2 story steel structure, +/-50,000 square feet) and a Promenade with site work to connect the site to the new buildings. We anticipate the proposed buildings will be made up of a combination of the following: Type II-B construction, two-story, continuous concrete footings, concrete slab floor, metal moment frame columns and beams, metal deck and concrete composite 2nd floor, metal deck roof, exterior non-bearing metal stud wall framing, and interior non-bearing metal stud wall framing. It is assumed that the proposed drive aisles will be made up of aggregate base and hot mix asphalt. Currently the Student Union Building project area is comprised of a single store existing structure with concrete and asphaltic surface around the area. The University Center Building project area currently consists of an existing Palm Apartments Complex and a portion of the a strip mall surrounded by concrete and asphaltic surfaces. Adjacent improvements include and are not limited to existing parking areas with some solar canopies, Live Oak, a strip mall, and the College of the Sequoias campus. Campus borders include W Noble Ave/CA-198 to the north, S Mooney Blvd/commercial properties to the east, W Tulare Ave/commercial properties to the south, paved parking areas to the southwest, and S Woodland St./parking/residential properties to the west.

The majority of the site appears to be fairly planar.

B. GEOLOGIC SETTING

According to the California Department of Conservation's Geologic Atlas of California, Fresno Sheet, and the 2010 Geologic Map of California, the project site is situated on Pleistocene-Holocene nonmarine (continental) and marine sedimentary rocks (Q). Based on the California Department of Conservation's Geological Survey maps, the site is not located in an Alquist-Priolo (earthquake fault) Special Study Zone. Nearby active earthquake faults include the following:

Kern Front.....	32.9 miles/	53.0 kilometers
Great Valley 14.....	42.1 miles/	67.7 kilometers
Great Valley 13.....	48.3 miles/	77.8 kilometers

Major fault systems and their distances from the site are given in the EQFault Summary attached in Appendix D. The largest estimated peak site acceleration, based on deterministic methods, is 0.1036-g from a magnitude 8.0 earthquake on the San Andreas – Whole M1-a fault approximately 108.4 miles away. See Appendix D for copies of the computer modeling.

C. SUBSURFACE CONDITIONS

Subsurface soils encountered in our field investigation consisted mainly of alternating soil layers of a loose to medium dense, fine to medium grained, and cohesive Silty Sand, and a medium stiff to hard Sandy Silt. Also encountered was a medium plasticity and very stiff Sandy Clay and a

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loose to medium dense, fine grained Poorly Graded Sand. These soils are classified as SM, ML, CL, and SP respectively in the Unified Soil Classification System (USCS).

On site soils are considered to have a very low expansion potential. Expansive soils are defined in the 2022 California Building Code (CBC), Section 1803A.5.3. Soils are considered to be expansive when the EI result is greater than 20, per ASTM D4829, Expansion Index of Soils. Design of foundations for structures shall be designed in accordance with the 2022 CBC, Sections 1808A.6.1, & 1808A.6.2.

Detailed descriptions of the various soils encountered during our field investigation are shown on Figures 2 through 12 in Appendix B, "Field Investigation." A "Key to Symbols" legend describing the symbols in the boring logs is also attached.

D. GROUNDWATER

Groundwater was not encountered during the field exploration in any of the soil boring B-1 to B-11. The depth to the unconfined aquifer as shown on maps prepared by the Department of Water Resources (DWR) and presented on the SGMA Data Viewer and dated Spring 2023 is approximately 161' below the ground surface. Historical depth to water data by the DWR and presented on the Water Data Library Station Map indicates high depth to water readings on nearby wells within 1-mile of the subject property ranged from 39.2' (1953) to 79.2' (2017) bgs.

E. SEISMIC DESIGN VALUES

The seismic design values tabulated below are based on the 2022 California Building Code (CBC). The Site Class for the proposed project was determined using standard penetration test data obtained at the site and documented in the attached Logs of Borings. The site is not in an Alquist-Priolo (earthquake fault) Special Study Zone.

SEISMIC DESIGN CRITERIA		VALUE	SOURCE
Risk Category		**III**	2022 CBC Table 1604.5 or 1604*A*.5
Site Class		**D**	2022 CBC § 1613.2.2 or 1613*A*.2.2; ASCE 7-16 Table. 20.3-1; Site Specific Soils Report
Mapped MCE_R Spectral Response Acceleration, short period	**S_S**	**0.553g**	SEAOC-OSHPD software; 2022 CBC Figure 1613.2.1(1)
Mapped MCE_R Spectral Response Acceleration, at 1-sec. Period	**S_1**	**0.219g**	SEAOC-OSHPD software; 2022 CBC Figure 1613.2.1(2)
Site Coefficient	**F_a**	**1.358**	SEAOC- OSHPD software; 2022 CBC Table 1613.2.3(1) or 1613*A*.2.3(1)
Site Coefficient	**F_v***	**2.162***	2022 CBC Table 1613.2.3(2) or 1613*A*.2.3(2)
Adjusted MCE_R Spectral Response Acceleration, short period, $F_a * S_s$	**S_{MS}**	**0.751g**	SEAOC- OSHPD software; 2022 CBC § 1613.2.3 or 1613*A*.2.3
Adjusted MCE_R Spectral Response Acceleration, 1-sec. period, $F_v * S_{1*} *$ 1.5	**S_{M1}***	**0.710g***	2022 CBC § 1613.2.3 or 1613*A*.2.3, ASCE 7-16, Supplement 3, § 11.4.8
Design Spectral Response Acceleration, short period, 2/3 * S_{MS}	**S_{DS}**	**0.5g**	SEAOC- OSHPD software; 2022 CBC § 1613.2.4 or 1613*A*.2.4

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SEISMIC DESIGN CRITERIA		VALUE	SOURCE
Design Spectral Response Acceleration, 1-sec. period, 2/3 * S_{MI}	**S_{D1}***	**0.473g***	2022 CBC § 1613.2.4 or 1613*A*.2.4
Peak Ground Acceleration for Max. Considered Earthquake (MCE_G)	**PGA**	**0.24g**	SEAOC- OSHPD software; ASCE 7-16 Fig 22-9
Site Coefficient, F_{PGA} = 1.36, F_{PGA}* PGA	**PGA_M**	**0.327g**	SEAOC- OSHPD software; ASCE 7-16 § 11.8.3.2
Seismic Design Category, short period		**D**	2022 CBC § 1613.2.5
Seismic Design Category, 1second period *		**D***	2022 CBC § 1613.2.5
**See requirements for site-specific ground motions in Section 11.4.8. The values tabulated above for S_{M1}, S_{D1}, and the Seismic Design Category/1-second period are based on the site coefficient, F_v, interpolated from 2022 CBC Table 1613.2.3(2) or 1613A.2.3(2) and Supplement 3, § 11.4.8.*			
MCE_R = Maximum Considered Earthquake (risk targeted) MCE_G = Maximum Considered Earthquake (geometric mean)			

EARTHWORK RECOMMENDATIONS

"Earthwork Specifications," in Appendix A are provided for general guidance in preparing site grading plans. In addition, the following specific recommendations are provided and supersede the latter wherever discrepancies may exist:

A. COMPACTION AND OPTIMUM MOISTURE

Unless otherwise specified herein, the terms, "Compaction," or "Compacted," wherever used or implied within this report should be interpreted as compaction to 90 percent of the maximum density obtainable by ASTM Test Method D1557. The term, "Optimum Moisture," wherever used or implied within this report, should be interpreted as that obtained by the above-described test method.

B. CLEARING & GRUBBING

Clearing and grubbing should consist of stripping grasses; removing existing structures - foundations, slabs, and miscellaneous concrete; removing buried utility lines; locating and removing or disposing of abandoned septic tanks and seepage pits (dry well) if any are encountered during site clearing and grubbing operations.

Slabs and Pavements - Shall be completely removed. Portland-Cement-Concrete (PCC) fragments may be used in fill provided they are broken down to a maximum dimension of two inches and adequately disbursed within a friable soil matrix. Soil PCC mixtures should not be used above the elevation bottom of the lowest structure footing.

Foundations - Existing at the time of grading should be completely removed.

Basements and septic tanks located in proposed structure areas shall be completely removed. Basements or septic tanks situated outside structure areas may be removed or disposed of by breaking the walls down to not less than two feet below finished grade;

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breaking the bottom out to provide drainage, and back-filling and compacting the resulting cavity using a sand slurry or by placing and compacting acceptable soils engineered fill. If a sand slurry is used, no compaction tests will be required.

Seepage pits in proposed structure areas should be removed to a minimum depth of five feet below finished grade or two feet below existing ground, whichever is lower. If a portion of the pit liner is to be abandoned in place, the void should be backfilled with sand slurry. In no instances should liners be left in place within a depth of two feet below existing ground.

Buried Utilities - such as sewer, water and gas lines or electrical conduits to remain in service shall be re-routed to pass no closer than four (4.0) feet to the outside edge of proposed structure footings. Lines to be abandoned shall be completely removed to a minimum depth of two (2.0) feet below finished building pad grade.

Cavities - resulting from clearing and grubbing or cavities existing on the site as a result of man-made or natural activity shall be backfilled with earth materials placed and compacted in accordance with Sections 5.3 and 5.4 of appendix A.

Stripping - Prior to site grading, existing ground surfaces should be stripped of existing pavement, surface vegetation, and high-volume root masses. A stripping depth of one to three inches is generally adequate. Stripped organic material shall not be used as engineered fill or blended with or incorporated into any materials which will underlie any structures or other improvements on the project. Removal of trees or other large plants shall include all roots larger than ¾" diameter. If necessary, root remnants are to be removed by hand-picking. Remove existing structures and improvements, including within the limits of grading or as depicted in the project documents.

C. GROUND SURFACE PREPARATION

Proposed Structure Areas:

The surface soil contains lenses of loose material in the top five feet. They are compressible and shall be excavated after the demolition operation is performed to prepare the project area to receive the proposed structures. Accordingly, ground surfaces in the proposed structure areas should be compacted in accordance with the following procedures:

1. Excavate earth material in the proposed addition area to a minimum depth of five (5) feet below existing grade or two (2) feet below bottom of proposed foundation elevations, whichever is deeper.

2. The bottom of the excavation shall be reviewed by the geotechnical engineer or his or her on-site representative prior to any backfill operations. *The top eight inches of materials exposed at the bottom of the excavation shall be scarified and compacted to a minimum of 90 percent of ASTM D-1557.*

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3. Moisten soils to near the optimum moisture or to a moisture consistent with effective compaction and soil stability. Compact moistened soils to a minimum of 90 percent of the maximum density obtained by ASTM Test Method D1557.

4. Work to lines at least five (5) feet beyond the outside edges of exterior footings and two feet beyond pavement edges. Where existing improvements may be affected by the excavation and/or compaction activities, the geotechnical engineer, the civil engineer, and the architect shall be notified as quickly as possible so that specific recommendations may be formulated. In no case shall the contractor proceed if there is the potential to undermine or damage adjacent structures, improvements, or utilities.

5. Prior to proceeding with excavation adjacent to the existing structure, the contractor should prepare and submit for review, a plan depicting all the areas to be excavated and backfilled using the "slot cut" method. The plan should show depths and lengths of existing foundations and depths, lengths, and widths of excavation segments, and the sequence of the excavations.

Proposed Isolated Structure Areas:

Isolated Structure such as CMU Wall and trash enclosure/service yard should be compacted in accordance with the following procedures:

1. Excavate earth material in the proposed addition area to a minimum depth of two (2) feet below existing grade or one (1) foot below bottom of proposed foundation elevations, whichever is deeper.

2. The bottom of the excavation shall be reviewed by the geotechnical engineer or his or her on-site representative prior to any backfill operations. *The top eight inches of materials exposed at the bottom of the excavation shall be scarified and compacted to a minimum of 90 percent of ASTM D-1557.*

3. Moisten soils to near the optimum moisture or to a moisture consistent with effective compaction and soil stability. Compact moistened soils to a minimum of 90 percent of the maximum density obtained by ASTM Test Method D1557.

4. Work to lines at least two (2) feet beyond the outside edges of exterior footings

Review of Excavation Bottoms:

Prior to placement of backfill, excavation bottoms shall be reviewed for indications of loose-fill, discoloration, or loose, compressible, native materials. Where these are encountered, they should be excavated and removed, or excavated and compacted as directed by the geotechnical engineer. Excavation of native soils shall continue in vertical increments of one foot until relative compaction tests taken at the bottom of the working surface (excavation bottom) equal or exceed 80 percent relative compaction. Fill placement in excavations shall not proceed until the geotechnical engineer or his or her

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representative on the site has reviewed, tested as described above and accepted materials exposed at the bottom of the excavation.

Pavement:

Ground surfaces to receive concrete driveways or bituminous pavements should be scarified and compacted to a minimum depth of 12 inches below the grading plane in cut areas or to a depth of 12 inches below the existing ground surface exposed after stripping in areas to receive fill.

Engineered fill placed in proposed pavement areas should conform to the requirements of Section 5.4, "Placing, Spreading and Compacting Fill Materials," of Appendix A.

Compaction in proposed pavement areas should be a minimum of 90 percent of the maximum density as obtained by ASTM Test Method D1557 and should extend to a minimum of two feet beyond the outside edges of pavements. The top one foot (1.0') of subgrade below the grading plane shall be compacted to a minimum of 95%. Ground surface preparation for paved areas should extend laterally two feet (2.0') beyond the pavement edges.

Utility Lines:

Backfill for utility lines traversing areas proposed for facilities, pavements, concrete slabs-on-grade, or areas to receive engineered fill for future construction should be compacted in accordance with the same requirements for adjacent and/or overlying fill materials.

Where utility trenches extend under, adjacent to, or near the structure, including patio(s), porch(es), garage, etc., the soil in the entire depth of the trench, shall be compacted. Compaction shall extend at least five feet beyond the outside the edge of the structure. Low-permeability, non-expansive soils shall be used for backfill.

Compaction should include haunch area, spring line and from top of pipe to finished subgrade. The haunch area up to one foot above the top of the pipe should be backfilled with "cohesionless" material.

Cohesionless native materials may be used for trench and pipe or conduit backfill. The term "cohesionless," as used herein, is defined as material which when dry, will flow readily in the haunch areas of the pipe trench. Pipe backfill materials should not contain rocks larger than two inches in maximum dimension. Where adjacent native materials exposed on the trench bottoms contain protruding rock fragments larger than two inches in maximum dimension, conduits and pipelines should be laid on a bedding consisting of clean, cohesionless sand (SP), in the Unified Soils Classification System.

Compaction Requirements - where not otherwise specified in the project documents, or in the manufacturer's specifications, or in these recommendations, the following compaction requirements are applicable to all electrical, gas or water conduits:

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TABLE A COMPACTION DEPTH			
Area	**Haunch to 1 ft. Above Top Of Pipe**	**1 ft. Above Top of Pipe to 2'6" Below Finished Grade**	**2'6" Below Finished Grade to Finished Subgrade**
Structural	90%	90%	90%
Pavements	90%	90%	90%
Non-Structural	90%	90%	90%

D. ENGINEERED FILL

Earth materials obtained on site are acceptable for use as engineered fill provided that vegetation and other deleterious debris are removed by proper stripping and separation.

Engineered fill material which has been moisture-conditioned to near the optimum moisture content, or to a moisture content commensurate with effective compaction and soil stability, should be placed in thin uniform layers (less than ten inches uncompacted thickness) and compacted. Refer to "Placing, Spreading and Compacting Fill Materials," in Appendix A.

E. IMPORTED FILL

Tabulated below are general guidelines for acceptance of imported engineered fill. Materials of equal of better quality than on-site material could be reviewed by the Geotechnical Engineer on a case-by-case basis. No soil materials shall be imported onto the project site without prior approval by the Geotechnical Engineer. Any deviation from the specifications given below shall require prior approval by the Geotechnical Engineer prior to import operations.

MAXIMUM PERCENT PASSING #200 SIEVE 40
MAXIMUM PERCENT RETAINED 3" SIEVE 0
MAXIMUM PERCENT RETAINED 1½" SIEVE *FOR BUILDING AREAS*. 15
MAXIMUM PERCENT RETAINED ¾" SIEVE *FOR LANDSCAPE AREAS* 5
MAXIMUM LIQUID LIMIT 40
MAXIMUM PLASTICITY INDEX 14
MINIMUM R-VALUE FOR PAVEMENT AREAS 50
MAXIMUM EXPANSION INDEX 20

Furthermore, the soils proposed for import shall be generally homogenous and shall not contain cemented and/or clayey and/or silty lumps larger than one inch. When such lumps are present, they shall not represent more than ten percent (10%) of the material by dry weight. Where a proposed import source contains obviously variable soils, such as clay and/or silt layers, the soils which do not meet the above requirements shall be segregated and not used for this project or the various layers shall be thoroughly mixed prior to sampling and testing by the Geotechnical Engineer.

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The contractor shall provide sufficient notice, prior to import operations, to allow sampling, testing, and evaluation of the proposed import material(s). Because of the time needed to perform the above tests, the contractor shall provide a means by which the Geotechnical Engineer, or others, can verify that the material which was sampled and tested is the same material which is being imported to the project.

F. DRAINAGE

Finish grading and construction of all improvements should be completed in such a manner that there will be no opportunity for water to collect on and/or percolate into the soils adjacent to or near the appurtenant structures or improvements including driveways and sidewalks).

Finish ground surfaces adjacent to the proposed structures should be graded to provide positive, free, and unobstructed drainage away from the foundations for at least five (5) feet. The recommended drainage should be established prior to enclosing the structure.

Drainage should continue by way of drain inlets and pipes or by surface grading to the street. No construction or finish grading should be established or maintained that would allow surface water from on-site or off-site sources to pond or accumulate near foundations or slabs or behind curbs. In areas where such adverse drainage conditions may exist or be created, area drains and/or catch basins with subsurface piping should be installed to collect and convey water to an approved water retention basin or, where permitted, to the adjacent city curb-and-gutter system.

Landscape irrigation should be stringently controlled. Do not apply irrigation water in excess of that needed by the landscape plantings. No water shall be applied to the ground adjacent to or near the structure or appurtenant structures or improvements (including patio(s), porch(es), garage, driveways, sidewalks, etc.).

Where ground surfaces adjacent to subsurface walls are to be landscaped, walls should be waterproofed. Installation of gravel-filled drains to route subsurface drainage away from walls is recommended.

FOUNDATION RECOMMENDATIONS

The new buildings can be adequately supported on spread footings. Foundation design parameters are provided below.

Spread Footings – The proposed foundation could be supported on continuous spread footings in accordance with the following Table B:

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TABLE B FOUNDATION DESIGN CRITERIA			
Foundation Type	**Minimum Width (ft.)**	**Minimum Depth Below Lowest Adjacent Subgrade (ft.)**	**Maximum Allowable Soil Bearing Pressure (lbs./sq. ft.)**
Continuous-Spread	1	1.5	3000
Isolated	1	1.5	3000

Bearing pressures given are for the minimum widths and depths shown above.

Bearing pressures given above are for dead and sustained (loads acting most of the time) live loads; they may be increased by one-third for wind and/or seismic loading conditions.

The proposed foundations shall be reinforced in accordance with the structural engineer's recommendations.

Settlement:

Provided maximum allowable soil bearing pressures given above are not exceeded, total settlement should not exceed one inch. A major portion two-thirds to one-half of total settlement should occur before the end of construction. Differential settlements should occur before the end of construction. Differential settlements should, accordingly, be less than one-half of an inch for a horizontal span of twenty feet.

Pole-Type Foundations Design – As general guidance structures may be supported on straight-shafted drilled piers. Pier design criteria are given below:

1. Friction Values: We recommend a friction value or skin friction (fs) of 300 psf. This value is for dead load plus live loads and can be increased by 1/3 for the total of all loads, including wind or seismic forces. Uplift pressure may be taken as three fourths (3/4) of the downward capacity.

   The top one foot (1.0') of the below-grade portion of the pier shall be excluded when determining the pier frictional resistance.

2. Allowable Lateral Soil Bearing Pressure: This type of foundation can be designed in accordance with Section 1807.3 of the 2022 CBC. However, it is recommended that an allowable lateral soil bearing pressure of 180 per foot of embedment be used to develop parameters S1 and S3 rather than one of the values given in Table 1806.2. This value includes a factor of safety of 2. The upper one foot of the soil should be ignored when calculating the minimum embedment depth. The lateral bearing pressure shall be permitted to be increased by 1/3 where used with the alternative basic load combination of CBC Section 1605A.3.2 that include wind or earthquake loads.

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MODULUS OF SUBGRADE REACTION

Modulus of subgrade reaction for use in design of foundations is based on ranges of values for soil types provided by Foundation Analysis and Design by Joseph E Bowles.[1] Equation 1 should be used for footings on sandy soils. Foundations on clay soils should employ Equation 2. Equation 3 is for rectangular footings having dimensions **w = b** (width) and **l = mb** (length) the variable "**m**" being the ratio of the length to the width of the foundation**.** K_{s1} is the modulus of subgrade reaction from the source referenced above based on a 1 foot x 1 foot square plate. For general guidance K_{s1} of 200 kcf may be used for the subsurface soils.

Equation (1) $$k_{sf} = K_{s1} \times \left(\frac{B+1}{2B}\right)^2$$

Equation (2) $$k_{sf} = K_{s1} \times B$$

Equation (3) $$k_{sf} = K_{s1} \times \frac{m+.5}{1.5 \times m}$$

Values given above should be used for guidance. Local values may be higher or lower and should be based on results of in-situ plate bearing tests performed in accordance with ASTM Test Method D1194.

LATERAL EARTH PRESSURES

Lateral earth pressures and friction coefficients for determining the passive lateral resistance of foundations against lateral movement and the active lateral forces against retaining walls and subsurface walls, expressed as equivalent fluid pressures, are given below in **Table C**. Lateral earth pressures were computed assuming that backfill materials are essentially free draining and level; and that no surcharge loads or sloping backfills are present within a distance from the wall equal to or less than the height (H)* of the wall.

(H)* = the height of backfill above the lowest adjacent ground surface.

TABLE C
LATERAL EARTH PRESSURES

Case	Lateral Earth Pressures
Active	40 P.C.F.
Passive	400 P.C.F.
At-Rest	55 P.C.F.

[1] Bowles, Joseph E; FOUNDATION ANALYSIS AND DESIGN; McGraw-Hill Book Company (1977); Table 9-1 pg. 269

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Active Case: Active lateral earth pressures should be used when computing forces against free standing retaining walls, unrestrained at the tops. Active pressures should not be used where tilting outward of the walls is greater than .002H would not be desirable.

Passive Case: Passive lateral earth pressures should be used when computing the lateral resistance provided by undisturbed or compacted native soils against the movement of footing. When computing passive resistance, the upper one foot of embedment depth should be discounted.

At-Rest Case: At-rest pressures should be used for subsurface walls restrained at their tops by floor diaphragms or tie-backs and for retaining walls where tilting outward greater than .002 H would not be desirable.

Frictional Resistance: A friction coefficient of 0.43 may be used when computing the frictional resistance to sliding of footings, grade beams, and slabs-on-grade. Frictional resistance and passive lateral soil resistance may be combined without reduction.

SOIL CORROSIVITY

Soluble Sulfates (SO_4)

The highest Sulfate (SO4) concentration measured was 27 ppm.

Based on Table 19.3.1.1 “Exposure categories and classes” of ACI 318-14 “Building Code Requirements for Structural Concrete” the soil exposure is classified as S0. Per Table 19.3.2.1 “Requirement for Concrete by Exposure Class” of the same reference, no restriction applies to the cement type or mix design.

Chlorides (Cl)

The highest Chloride (Cl) concentration measured was 2.1 ppm. Generally, chloride concentrations greater than 500 ppm are considered to be corrosive to foundation elements. (Ref: Caltrans Corrosion Guidelines / Version 1.0)

pH

The soil pH measured between 8.24 and 10.16. Generally, a pH level less than 5.5 is considered to be corrosive to metals in foundation elements. (Ref: Caltrans Corrosion Guidelines/ Version 1.0).

Although preliminary test results indicate that soil corrosivity at the locations and depths tested is low to negligible, if the site grading operations will result in a blend of native and/or imported materials at finished subgrade elevations, additional tests should be performed after rough grading has been completed and prior to concrete and/or mechanical design.

The authors of this report, Soils Engineering, Inc., are not experts in the field of soil corrosivity. Should detailed analysis of soil corrosivity be required, it is our recommendation to contract a corrosion engineer.

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SLABS-ON-GROUND

Slabs-on-ground may be supported on earth materials prepared in accordance with the recommendations of this Geotechnical Investigation.

Moisture protection between the soil and the interior slabs-on-ground is recommended. For exceptions to slab moisture protection, refer to the 2022 California Building Code, §1907.1. The project designer should provide specific details regarding construction of the concrete slab-on-ground, including the moisture barrier or vapor retarder/barrier, capillary break (if included), and blotter material (if included). The American Concrete Institute recommends a minimum moisture vapor retarder of 10 mil thick polyethylene. The vapor retarder should be protected from damage. Punctures and tears should be repaired prior to concrete placement. If landscape irrigation is permitted within ten feet from building exteriors, the inclusion of a capillary break beneath slabs-on-grade should be given serious consideration.

It has been common local practice to use a sandy material as a blotter layer between the moisture barrier and the concrete to absorb some of the bleed water and to potentially reduce slab curling. However, a blotter layer may act as a moisture reservoir. If that occurs, all apparent advantages of its use are negated. A blotter layer should not be incorporated into the section design for moisture-sensitive slabs if it cannot be kept dry prior to concrete placement or if water may migrate into the layer after slab construction (e.g. wet curing, rainfall). If the slab-on-ground section is to include a blotter layer between the moisture barrier and the concrete, it is our recommendation that the blotter material consist of crusher fines (rock dust) or sand with angular, interlocking grains. The material should be easily compacted and should be screened so that 100% of the material is finer than ¼". Do not use blotter material which may be potentially reactive with the alkalis in the concrete or which has high sulfate content. At the time of concrete placement, the blotter material should be dry to damp, compact, and smooth. For slabs which are to be water-cured, a blotter layer should not be used. For further consideration, refer to the American Concrete Institute *Manual of Concrete Practice 302.1R and 360.*

Slab thicknesses, reinforcing, and the concrete characteristics should be in accordance with the project designer's recommendations. The 2022 California Building Code, §1907.1 requires that the slab thickness be not less than 3½".

Pressurized water lines should not be installed beneath slabs-on-ground. Where pressurized water lines must be routed beneath the slab, they should be routed entirely inside continuous sleeves with both ends open to the atmosphere above the slab surface. Gravity flow sewer lines may underlie slabs-on-ground, but they should be routed to the exterior point of connection by the shortest feasible path.

PAVEMENT RECOMMENDATIONS

The R-Value results ranged from 28 through 67 according to our testing program. The laboratory test reports are provided as Figures D-1 and D-2.

Hot Mix Asphalt (HMA) pavement

Based on an R-Value of 28, the asphalt concrete pavement section is as follows:

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TI of 5	0.25 feet of asphalt concrete and 0.55 feet of Class 2 Aggregate Base
TI of 6	0.30 feet of asphalt concrete and 0.65 feet of Class 2 Aggregate Base
TI of 7	0.35 feet of asphalt concrete and 0.75 feet of Class 2 Aggregate Base

HMA design should meet the requirements of the 2010 or newer, State of California, Standard Specifications Manual (SSM), Section 39. Aggregate Base should also meet the Class 2 requirements of the SSM, Section 26.

Concrete Pavement

For concrete subject to vehicle traffic with Average Daily Truck Traffic of 10 (car parking areas and access lanes), the concrete section should be 5 inches thick over 4 inches of Class 2 Aggregate Base, 4000 psi concrete without rebar.

For concrete subject to vehicle traffic with Average Daily Truck Traffic of 25 (entrance and service lane), the concrete section should be 6 inches thick over 4 inches of Class 2 Aggregate Base, 4000 psi concrete without rebar.

For concrete subject to vehicle traffic with Average Daily Truck Traffic of 300 (bus parking areas, city and school buses parking area and interior lanes), the concrete section should be 6.5 inches thick over 4 inches of Class 2 Aggregate Base, 4000 psi concrete without rebar.

Ground surfaces to receive HMA and concrete pavement should be scarified and compacted to a minimum depth of 12 inches below the grading plane in cut areas or to 12 inches in areas to receive fill. Engineered fill placed in proposed pavement areas should conform to the requirements of section 5.4, “Placing, Spreading and Compacting Fill Materials,” of Appendix A.

LIMITATIONS, OBSERVATION AND TESTING

Conclusions and recommendations in this report are given for the proposed new University Center & Student Union Buildings located at 915 S. Mooney Blvd, Visalia, Tulare County, California:

a. The information retrieved from exploratory borings drilled at the subject site to a maximum depth of 51.5 feet below the existing ground surface;

b. Our laboratory testing program results;

c. Our engineering analysis based on the information defined in this report;

d. Our experience in the Tulare County area.

Variations in soil type, strength and consistency may exist between specific boring locations. These variations may not become evident until after the start of construction. If such variations appear, a re-evaluation of the soils test data and recommendations may be necessary.

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Unless a Geotechnical Engineer of this firm is afforded the opportunity to review plans and specifications, we accept no responsibility for compliance with design concepts or interpretations made by others with regard to foundation support, fill selection, fill placement or other recommendations presented in this report.

Changes in conditions of the subject property can occur with time because of natural processes or the works of man on the subject site or on adjacent properties. Changes in applicable engineering and construction standards can also occur as the result of legislation or from the broadening of knowledge. Accordingly, the finding of this report may be invalidated, wholly or in part, by changes beyond our control. Therefore, this report is subject to review and should not be relied upon without review after a period of two years or after any modifications to the site.

REVIEW OF EARTHWORK OPERATIONS

Review of earthwork operations relating to site clearing, ground stabilization, placement and compaction of fill materials, and finished grading is critical to the structural integrity of building foundation and floor systems.

While the preliminary Geotechnical investigation and report provide guidelines which are used by the design team, i.e., architects, grading engineers, structural engineers, landscape engineers, etc., in completing their respective tasks, review of plans and site review and testing during earthwork operations are vital adjuncts to the completion of the Geotechnical engineer's tasks. The most prevalent cause of failure of a structure foundation system is lack of adequate review and testing during the earthwork phase of the project.

Projects rarely reach completion without some alteration being required such as may result from a change in subsurface conditions, an amendment in the size and scope of the project, a revision of the grading plans or a variation in structural details. Occasionally, even minor changes can significantly affect the performance of foundations. The most prevalent secondary cause for foundation failure is inadequate implementation of Geotechnical recommendations during the formulation of foundation designs and grading plans. The error in a foundation design or an omission of a key element from a grading plan occurs most often as a result of inadequate communication between the various project consultants and -- when a change in consultants occurs -- improper transfer of authority and responsibility.[2]

It is imperative, therefore, that any revisions to the project scope, any change in structural detail, or change in consultant, be brought to the attention of Soils Engineering, Inc. to allow for timely review and revision of recommendations and for an orderly transfer of responsibility and approval. It is the responsibility of the owner or his or her representative to ensure that a representative of our firm is present at all times during earthwork operations relating to site preparation and grading, so that relative compaction tests can be performed, earthwork operations can be observed and compliance with the recommendations provided herein can be established. This engineering report has been prepared within the limits prescribed to us by the client or his or her

[2] If the civil engineer, the soils engineer, the engineering geologist or the testing agency of record is changed during the course of the work, the work shall be stopped until the replacement has agreed to accept the responsibility within the area of his or her technical competence for approval upon completion of the work.

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representative, in accordance with the generally accepted principles and practices of Geotechnical engineering. No other warranty, expressed or implied, is included or intended in this report.

Respectfully Submitted,
SOILS ENGINEERING, INC.

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APPENDIX A

GENERAL GUIDE SPECIFICATIONS FOR EARTHWORK

1. GENERAL

1.1 Scope

These specifications and plans include all earthwork pertaining to site rough grading including, but not limited to, furnishing all labor and equipment necessary for clearing and grubbing; stripping; preparation of ground surfaces to receive fill; excavation; placement and compaction of structural and non-structural fill; disposal of excess materials and products of clearing, grubbing, and stripping; and any other work necessary to bring ground elevations to the lines and grades shown on the project plans. Wherever exist discrepancies between these guide-specifications and the earthwork recommendations in Section I of the above geotechnical report, the most stringent recommendations shall supersede.

1.2 Performance:

It shall be the responsibility of the contractor to complete all earthwork in accordance with project plans and specifications. No variance from plans and specifications shall be permitted without written approval of the Engineer-of-Record, hereinafter referred to as the "Engineer" or his or her designated representative, hereinafter referred to as the "Soils Engineer." Earthwork shall not be considered complete until the "engineer" has issued a written statement confirming substantial compliance of earthwork operations to these specifications and to the project plans. The contractor shall assume sole responsibility for job site conditions during earthwork operations on the project, including safety of all persons and preservation of all property. This requirement shall apply continuously and not be limited to normal working hours. The contractor shall defend, indemnify, and hold harmless the owners, engineer, and soils engineer from all liability and claims, real or alleged, arising out of performance of earthwork on this project, except from liability incurred through sole negligence of the owner, engineers, or soils engineers.

2. DEFINITIONS

2.1 Excavations:

Excavation shall be defined within the content of these specifications as earth material excavated for constructing fill embankment; grading the site to elevations shown on project plans; or placing underground pipelines, conduits, or other subsurface utilities or minor structures.

Excavations shall be made true to the lines shown on project plans and to within plus or minus one-tenth (0.1) of a foot, of grades shown on the accepted site grading plans.

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2.2 Engineered Fill:

Engineered fill shall be construed within the body of these specifications as earth materials conforming to specifications provided in the soils or geotechnical report placed to raise the grade of the site, to backfill excavations, or to construct asphaltic concrete or Portland cement concrete pavement; and upon which the soils engineer has performed sufficient tests and has made sufficient observation during placement and compaction to enable him to issue a written statement confirming substantial conformance of the work to project earthwork specifications.

2.3 On-Site Material:

On-site material is earth material obtained in excavation made on the project site.

2.4 Imported Material:

Imported materials are earth materials obtained off the site, hauled in, and placed as fill.

2.5 "Compaction" or "Compacted:"

Wherever expressed or implied within the context of these specifications shall be interpreted as compaction to ninety (90) percent of the maximum density obtainable by ASTM Test Method D1557.

2.6 Grading Plane:

The grading Plane is the surface of the basement material upon which the lowest layer of subbase, base, asphaltic or Portland cement concrete, surfacing, or another specified layer is placed.

3. SITE CONDITIONS

The contractor shall visit the site, prior to bid submittal, to explore existing subsurface conditions; to survey site topographic, and to define the nature of materials that may be encountered while performing its work under this contract. Moreover, the contractor shall make his or her own interpretation of the contents of the Geotechnical Report, as they pertain to said conditions. The contractor shall assume all liability under the contract for any loss sustained as a result of variations which may exist between specific soil boring locations or changed conditions resulting from natural or man-made circumstances occurring after the date of the Preliminary Field Investigations.

4. CLEARING AND GRUBBING

4.1 Clearing and Grubbing

Clearing and grubbing shall consist of removing all debris such as metal, broken concrete, trash, vegetation growth and other biodegradable substances, from all

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areas to be graded. Existing obstructions below shall be removed in accordance with the following procedures:

4.1.1 Slabs and Pavements - Shall be completely removed. Asphaltic or Portland Cement, concrete fragments may be used in engineered fills provided they are broken down to a maximum dimension of six (6.0) inches and thoroughly dispersed within a friable soil matrix. Engineered fill containing said fragments should not be placed above the elevation of the bottom of the lowest structure footing.

4.1.2 Foundations - Existing at the time of grading shall be removed to a depth not less than two (2.0) feet below the bottom of the lowest structure footing.

4.1.3 Basements, Septic Tanks – Buried concrete containers of similar construction located within areas destined to receive pavements, structures, or engineered fills should be completely removed and disposed of off the site. Basements, septic tanks, etc., situated outside structures, or structural fill areas shall be disposed of by breaking an opening in bottoms to permit drainage, and by breaking walls down to not less than two (2.0) feet below finished subgrade.

4.1.4 Buried Utilities – Such as sewer, water and gas lines or electrical conduits to remain in service shall be re-routed to pass no closer than four (4.0) feet to the outside edge of proposed exterior footings of structures. Lines to be abandoned shall be completely removed to a minimum depth of two (2.0) feet below finished building pad grade. Concrete lines deeper than two (2.0) feet below finished building pad grade and having diameters less than six (6.0) inches can be crushed in place.

4.1.5 Root Systems – Shall be completely removed to a minimum depth of two (2.0) feet below the bottom of the lowest proposed structure footing or to two (2.0) feet below finished subgrade, whichever depth is lower. Root systems deeper than the elevation indicated above shall be excavated to allow no roots larger than two (2.0) inches in diameter.

4.1.6 Cavities – Resulting from clearing and grubbing or cavities existing on the site because of man-made or natural activity shall be backfilled with earth materials placed and compacted in accordance with Sections 5.3 and 5.4 of these specifications.

4.1.7 Preservation or Monuments, Construction Stakes, Property Corner Stakes, or other temporary or permanent horizontal or vertical control reference points shall be the responsibility of the contractor. Where these markers are disturbed, they shall be replaced at the contractor's expense.

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5. SITE GRADING

Site grading shall consist of excavation and placement of fills to lines and grades shown on the project plans and in accordance with project specifications and recommendations of this report, whichever is more stringent. The following are recommendations issued in this report:

5.1 Areas to Receive Fill:

5.1.1 Surfaces to receive fill shall be scarified to a depth of at least six (6.0) inches, or as recommended in this report, whichever is greater, until the surface is free from ruts, hummocks or other uneven features which would tend to prevent uniform compaction by the equipment to be used.

5.1.2 After the area to receive fill has been cleared and scarified, it shall be moistened and compacted to a depth of at least six (6.0) inches in accordance with specifications for compacting fill material in paragraph 5.4, below.

5.2 Excavation:

5.2.1 Excavations shall be cut to elevations plus or minus 0.1 foot of the grades shown on the accepted plans.

5.2.2 When excavated materials are to be used in engineered fill, the excavation shall be made in a manner to produce as much mixing of the excavated materials as practicable.

5.2.3 When excavations are to be backfilled, and where surfaces exposed by excavation are to support structures or concrete floor slabs, the exposed surfaces shall be scarified, moistened and compacted, as stated above, for areas to receive fill. Over excavation below specified depths will not eliminate the requirement for exposed surface compaction.

5.3 Fill Materials:

5.3.1 Materials obtained from on-site excavations will be considered satisfactory for construction of on-site engineered fills, unless otherwise stated in the Soils Report or Foundation Investigation. If unexpected pockets of poor or weak materials are encountered in excavations, and they cannot be upgraded by mixing with other materials or by other means, they may be rejected by the soils engineer for use in engineered fill. Rocks larger than 12 inches in size in any dimension shall not be allowed in the proposed building area. If a large amount of rocks greater than 12 inches in size in any dimension is encountered, a rock disposal area shall be located on the grading plan. Rocks shall be mixed with well-graded soils to assure that the voids in these areas will fill properly.

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5.3.2 When imported fill materials are necessary to bring the site up to planned grades, no material shall be imported prior to its approval and acceptance by the soils engineer.

5.3.2 The soils engineer shall be given notice of the proposed source of imported materials with adequate time allowance for his or her testing of the proposed materials. The time required for testing will vary with different types of materials, job conditions, and ultimate function of filled areas. Under best conditions the time requirement will not be less than 48 hours.

5.4 Placing, Spreading, and Compacting Fill Material:

5.4.1 The fill materials shall be placed in layers which, when compacted, shall not exceed six (6.0) inches in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer. Increased thickness of layers may be approved by the soils engineer when conditions warrant.

5.4.2 All fills shall be placed in level layers; layers shall be continuous over the area of any structural unit, and all portions of the fill shall be brought up simultaneously within the area of any structural unit. When imported material is used, it must be placed so that its thickness is as uniform as possible within the area of any structural unit.

5.4.3 When materials are to be excavated and replaced in a compacted condition, segmented, or leap-frogging of cut-fill operations within the area of any structural unit will not be permitted unless the method is specifically described by the soils engineer.

5.4.4 When the moisture content of fill material is below the lower limit specified by the Soils Engineer, water shall be added until the moisture content is as specified; and when it is above the upper limit specified, the material shall be aerated by blading or other satisfactory methods until the moisture content is as specified.

5.4.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted to not less than ninety (90) percent of maximum density in accordance with ASTM Density Test Method D1557. Compaction shall be by equipment of such design that it will be able to compact the fill to specified density. When the soils engineer specifies a specific type of compaction equipment to be used, such equipment shall be used as specified.

5.4.6 Compaction of each layer shall be continuous over its entire area and the equipment shall make sufficient trips to ensure that the desired density has been obtained.

5.4.7 Field density tests shall be made by the soils engineer. The compaction of each layer of fill shall be subject to testing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches.

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Density tests shall be taken in the compacted material below the disturbed surface. When tests indicate the density of any layer of fill or portion thereof is below the required ninety (90) percent density, the layer or portion shall be re-worked until the required density has been obtained.

5.4.8 When the soils engineer specifies compaction to other standards or to percentages other than ninety (90) percent, such specification, with respect to the items, shall supersede these specifications.

5.4.9 The fill operation shall be continued in six (6) inch compacted layers, as specified above, until the fill has been brought to within 0.1 foot, plus or minus, of the finished slopes and grades, as shown on the accepted plans. The finished surface of fill areas shall be graded or bladed to a smooth and uniform surface and no loose material shall be left on the surface.

5.4.10 No fill materials shall be placed, spread, or compacted while it is frozen or thawing or during unfavorable weather conditions. When work is interrupted by weather conditions, fill operations shall not be resumed until the soils engineer indicates that moisture content and density of previously placed fill are satisfactory.

5.5 Observations and Testing:

5.5.1 The soils engineer shall be provided with a 48-hour notice, in order that he may be present at the site during all earthwork activities related to excavation, tree root removal, stripping, backfill, and compaction and filling of the site and to perform periodic compaction tests so that substantial conformance to these recommendations can be established.

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APPENDIX B

FIELD INVESTIGATION

Eleven (11) test borings were drilled at the subject site and terminated at a maximum depth of 51.5 feet below the existing ground surface. Borings were advanced using an (4.25) inch hollow-stem auger. Test data and descriptions from these holes form the basis of the conclusions and recommendations contained in this report.

Undisturbed samples and disturbed bulk samples were obtained. Undisturbed samples were taken using either a 2-3/8” (inside diameter) split-barrel sampler or a 1-3/8” (inside diameter), 2” (outside diameter) Standard Penetration Sampler (SPT). Penetration resistance of undisturbed soils was obtained by driving the above-described sampler using a one-hundred-forty-pound hammer falling thirty inches (30"). Blow counts for each six inch (6") driven increment was recorded and are reported on the Test Borings Logs. In addition, bulk soil samples, selected as most representative of near surface soils encountered, were taken for laboratory testing.

As drilling progressed, earth materials encountered were logged and classified in accordance with the Unified Soils Classification System and presented graphically on Logs of Test Borings, Figures 2 through 12, along with the Legend. Approximate locations of test borings are shown on the Boring Location Map, Figure 1.

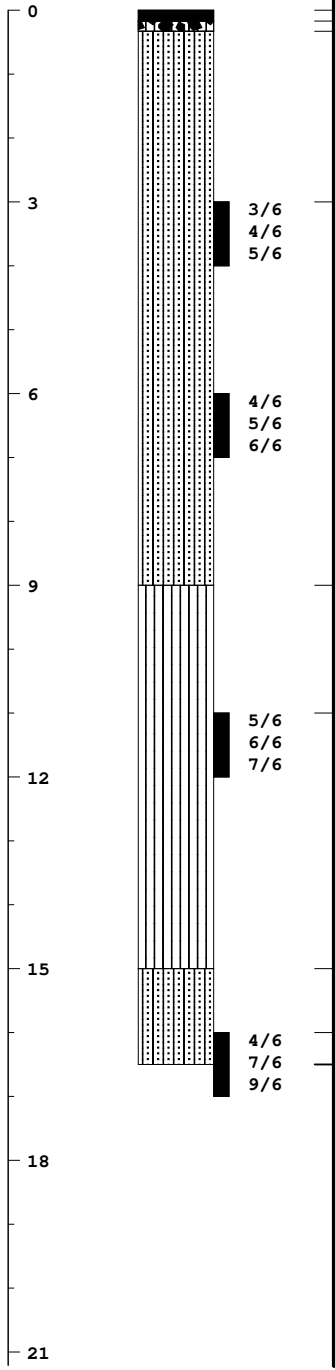
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Boring Location Map
Figure 1
SEI File No. 24-19596



LOG OF TEST BORING
BORING B-1

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/20/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/20/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/20/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*

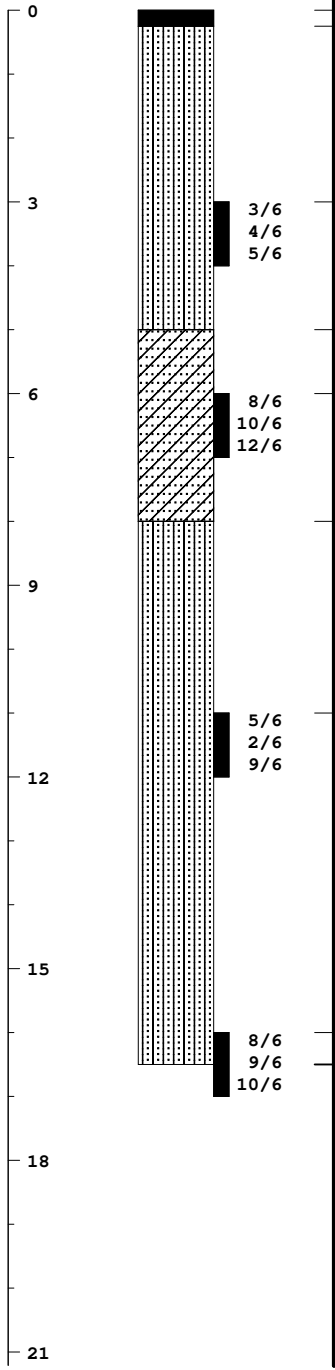


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		GM	Approx. 2 inches asphaltic concrete.			
		SM	Approx. 2 inches aggregate base.			
3	3/6 4/6 5/6		SILTY SAND; brown, moist, fine, cohesive. Loose.		102.0	14.7
6	4/6 5/6 6/6				105.9	7.3
9		ML	SANDY SILT; brown, moist.			
12	5/6 6/6 7/6		Stiff.		108.8	13.5
15		SM	SILTY SAND; light brown, damp, fine, cohesive.			
	4/6 7/6 9/6		Medium dense.		110.3	13.8
18			BOTTOM.			
21						

Figure Number 2

LOG OF TEST BORING
BORING B-2

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/20/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/20/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/20/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*
LOGGER: *LW*

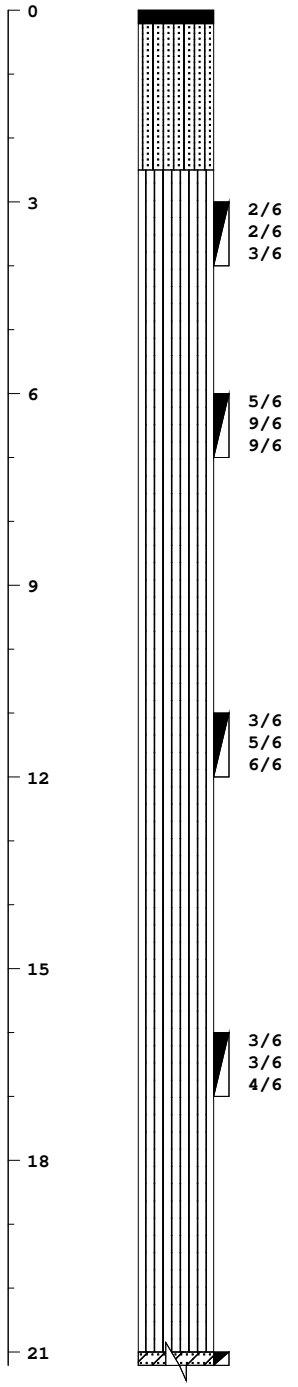


ELEVATION/ DEPTH (feet)	USCS	Description	Remarks	Density pcf	Moisture %
0	SM	Approx. 3 inches asphaltic concrete. SILTY SAND; brown, moist, cohesive.			
3		Loose.		113.3	13.8
6	SC	CLAYEY SAND; brown, moist, low plasticity. Medium dense.		115.7	13.3
9	SM	SILTY SAND; brown, damp to moist, cohesive, fine.			
12		Loose.		110.3	12.7
15		Medium dense.		104.0	22.1
18		BOTTOM.			
21					

Figure Number 3

LOG OF TEST BORING
BORING B-3

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*
LOGGER: *LW*

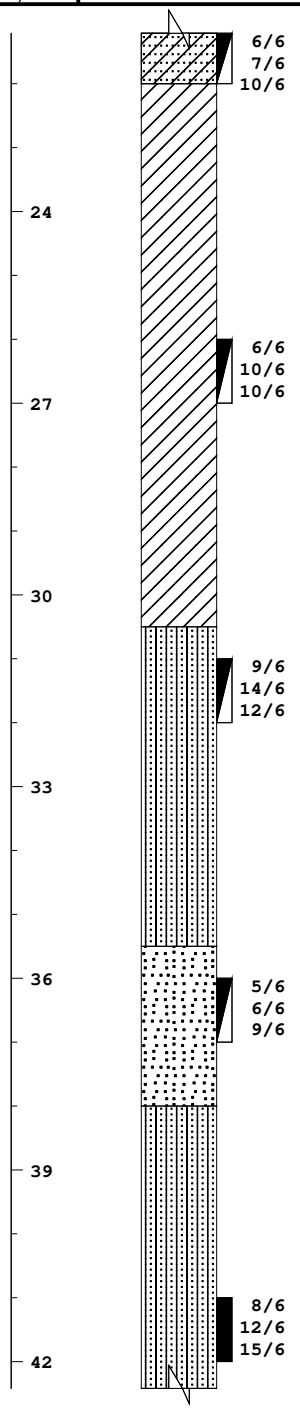


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SM	Approx. 2.5 inches asphaltic concrete. Rock sand below AC.			
		ML	SILTY SAND; yellowish brown, damp, cohesive.			
3	2/6 2/6 3/6		SANDY SILT; brown, moist. Medium stiff.			16.9
6	5/6 9/6 9/6		Very stiff.			14.5
9		ML	SANDY SILT; yellowish brown, moist, fine, cohesive.			
12	3/6 5/6 6/6		Stiff.			11.5
15	3/6 3/6 4/6		Medium stiff.			15.0
18						
21						

Figure Number 4

LOG OF TEST BORING
BORING B-3

PROJECT: *University Center & Student Union Buildings* **FILE NO:** *19596*
BORING DATE: *03/25/24* **ELEV.:**
BORING LOCATION: *See Boring Location Map, Figure 1* **START:** *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger* **FINISH:** *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A* **LOGGER:** *LW*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SC	CLAYEY SAND; olive brown, moist, medium plasticity.			12.6
		CL	SANDY CLAY; olive brown, moist, medium plasticity.			
			Very stiff.			19.0
		SM	SILTY SAND; light brown, damp, fine, cohesive, traces of clay. Medium dense.			9.3
		SP	POORLY GRADED SAND; light yellowish brown, fine grained.			5.5
		SM	SILTY SAND; light brown, damp to moist, fine to medium grained, traces of clay.			
			Medium dense.			5.6

Figure Number 4

LOG OF TEST BORING
BORING B-3

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▽ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
45		ML	SANDY SILT; yellowish brown, moist, traces of clay.			
	6/6 11/6 17/6		Very stiff.			18.2
48		SM	SILTY SAND; brown, moist, fine to medium grained.			
51	8/6 13/6 15/6		Medium dense.			4.5
			BOTTOM.			
54						
57						
60						
63						

Figure Number 4

LOG OF TEST BORING
BORING B-4

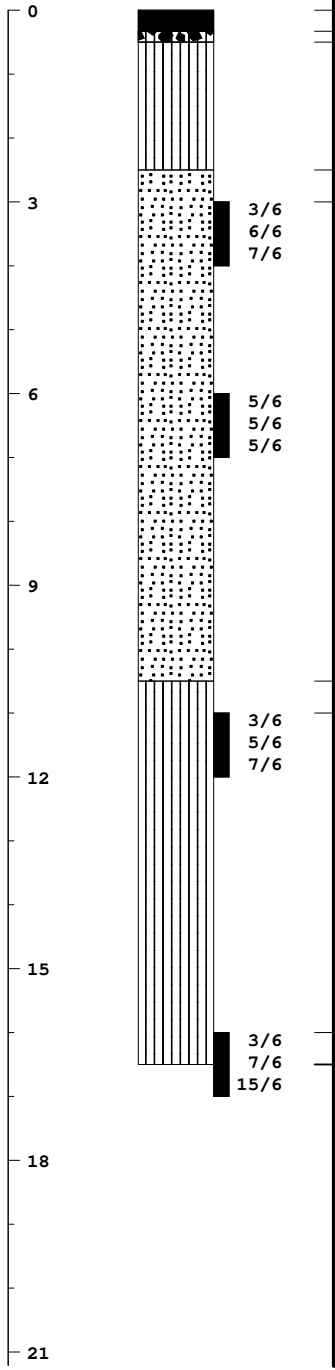
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FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *MW*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		GM	Approx. 4 inches asphaltic concrete.			
		ML	Approx. 2 inches aggregate base.			
3	3/6 3/6 3/6		SILT; dark brown, damp, low plasticity. Firm.		111.6	16.0
6	3/6 6/6 9/6		Brown, stiff.		109.3	13.1
9						
12	6/6 6/6 7/6		Medium stiff.		112.5	14.8
15	7/6 8/6 9/6		Stiff.		106.4	17.7
			BOTTOM.			
18						
21						

Figure Number 5

LOG OF TEST BORING
BORING B-5

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *MW*

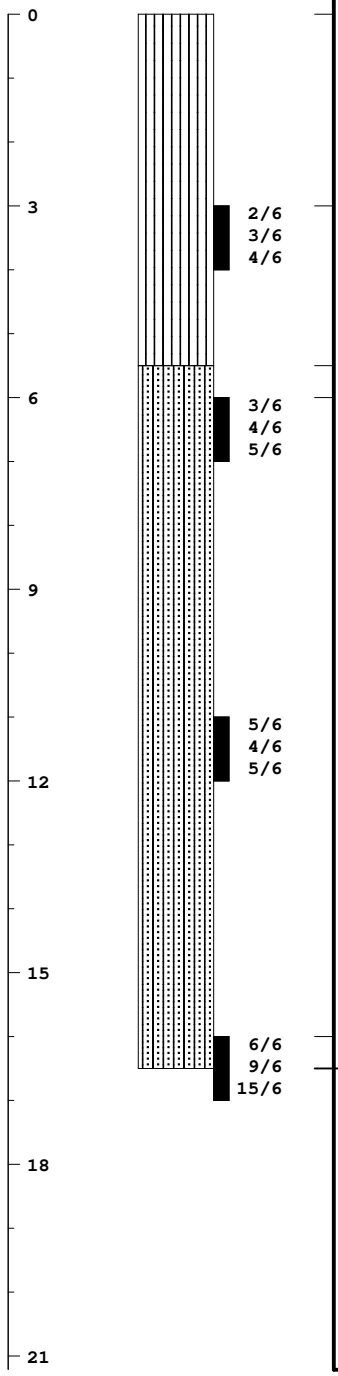


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		GM	Approx. 4 inches asphaltic concrete.			
		ML	Approx. 2 inches aggregate base.			
		SP	SILT; brown, damp.			
	3/6 6/6 7/6		POORLY GRADED SAND; light yellowish brown, dry, fine grained. Loose.		94.8	2.2
	5/6 5/6 5/6				96.4	2.8
	3/6 5/6 7/6	ML	SILT; brown, damp, low plasticity. Medium stiff.		116.7	13.5
	3/6 7/6 15/6		Stiff. BOTTOM.		115.7	16.5

Figure Number 6

LOG OF TEST BORING
BORING B-6

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ⬟ **:** *N/A*
LOGGER: *MW*

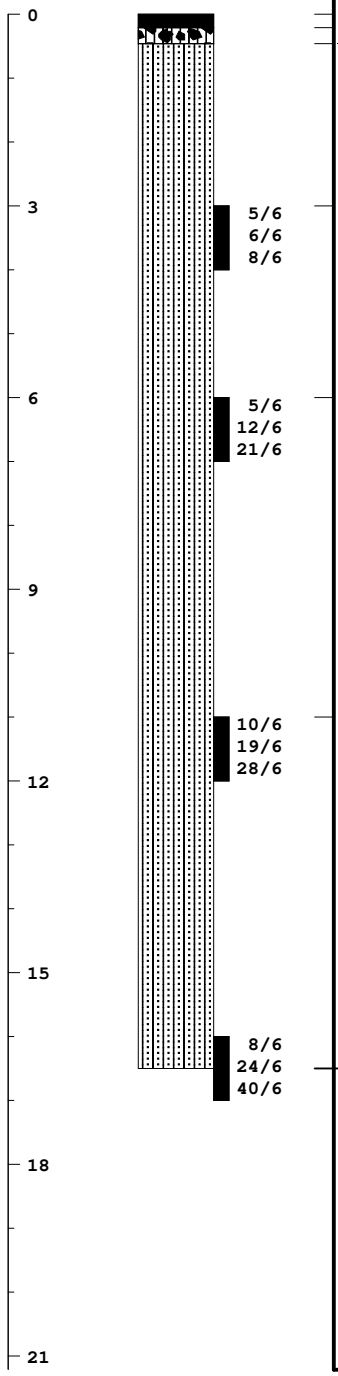


ELEVATION/ DEPTH (feet)	USCS	Description	Remarks	Density pcf	Moisture %
0	ML	SILT; dark brown, damp, low plasticity.			
3		Firm.		103.8	14.4
6	SM	SILTY SAND; yellowish brown, damp, fine grained. Loose.		113.8	9.3
12				112.1	16.2
15		Medium dense.		112.9	16.5
		BOTTOM.			
18					
21					

Figure Number 7

LOG OF TEST BORING
BORING B-7

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*
LOGGER: *LW*

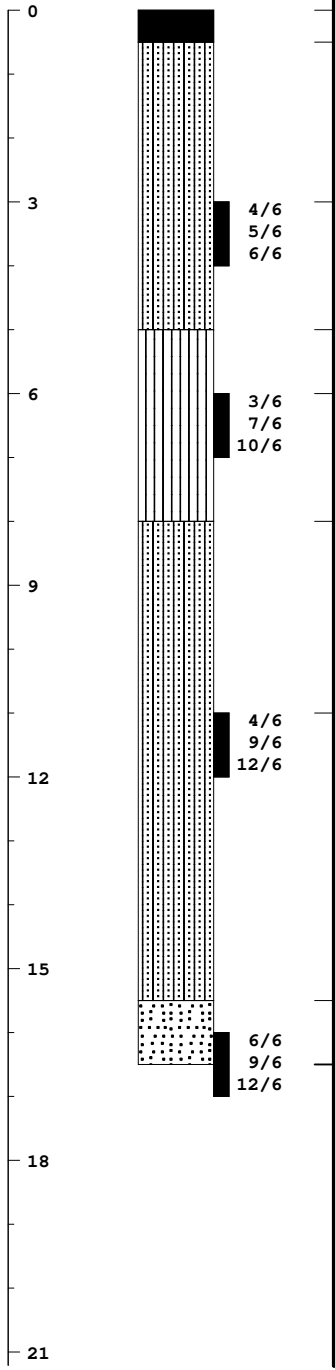


ELEVATION/ DEPTH (feet)	USCS	Description	Remarks	Density pcf	Moisture %
0	GM	Approx. 2.5 inches asphaltic concrete.			
	SM	Approx. 3 inches aggregate base.			
3		SILTY SAND; dark brown, with low plasticity clay, moist. Medium stiff.		106.3	14.3
6		Light brown, Medium dense, traces of clay.		114.9	6.6
12		Hard.		116.8	5.0
		BOTTOM.		114.2	6.0

Figure Number 8

LOG OF TEST BORING
BORING B-8

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *3/26/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *3/26/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *3/26/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▽ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*

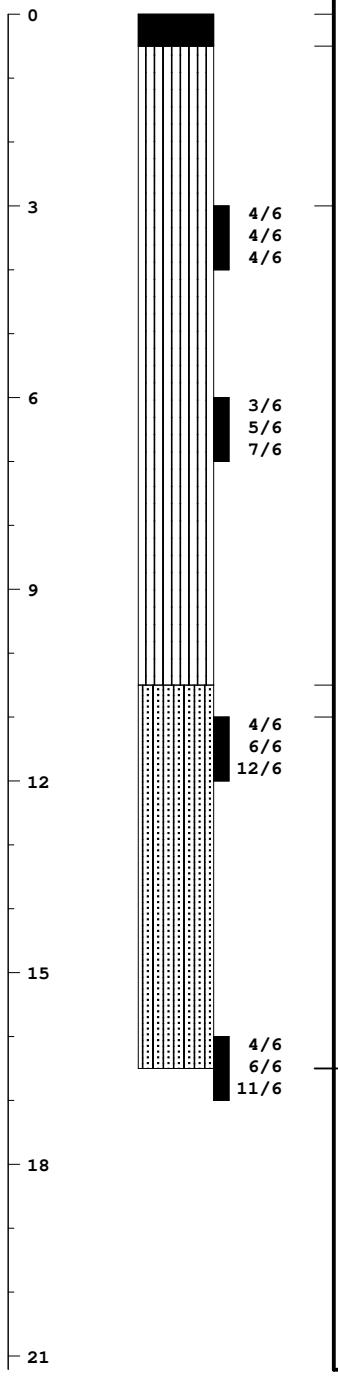


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SM	Approx. 6 inches concrete with 1/8 inch wire mesh. SILTY SAND; dark brown, moist, fine grained, cohesive.			
			Loose.		116.2	7.5
		ML	SANDY SILT; dark brown, moist.			
			Stiff.		119.0	10.6
		SM	SILTY SAND; yellowish brown, moist, fine, cohesive.			
			Medium dense.		113.1	5.4
		SP	POORLY GRADED SAND; yellowish brown, damp, fine grained.		103.7	2.3
			BOTTOM.			

Figure Number 9

LOG OF TEST BORING
BORING B-10

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *3/26/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *3/26/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *3/26/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ⬟ **:** *N/A*
LOGGER: *LW*

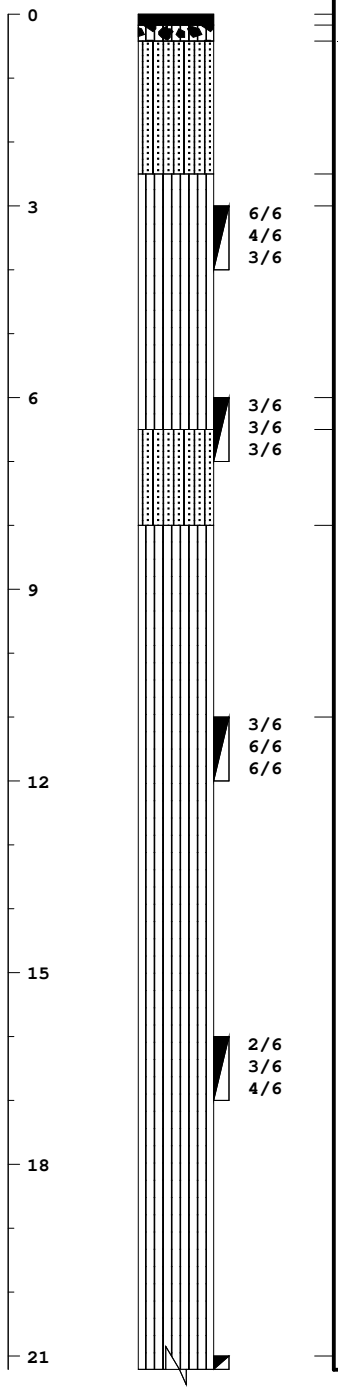


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		ML	Approx. 6 inches concrete with tree roots directly below. SANDY SILT; dark brown, damp to moist. Medium stiff.		111.0	10.5
					118.6	10.9
		SM	SILTY SAND; yellowish brown, moist, fine grained, cohesive. Medium dense.		117.0	7.7
			BOTTOM.		111.2	11.5

Figure Number 11

LOG OF TEST BORING
BORING B-11

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/26/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/26/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/26/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*

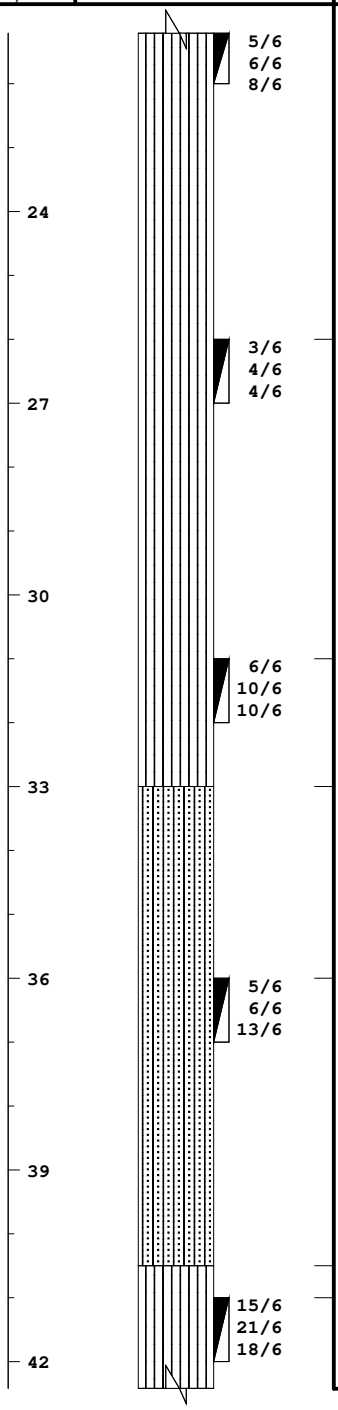


ELEVATION/ DEPTH (feet)	USCS	Description	Remarks	Density pcf	Moisture %
	GM	Approx. 2 inches concrete.			
	SM	No visible wire mesh. Approx. 3 inches aggregate base.			
	ML	SILTY SAND; dark brown, moist, fine, cohesive.			8.3
		SANDY SILT; dark brown, moist. Medium stiff.			
		Soft.			12.3
	SM	SILTY SAND; yellowish brown, damp to moist, fine grained.			
	ML	SANDY SILT; yellowish brown, moist, traces of clay.			
		Medium stiff.			11.3
					12.8

Figure Number 12

LOG OF TEST BORING
BORING B-11

PROJECT: *University Center & Student Union Buildings* **FILE NO:** *19596*
BORING DATE: *03/26/24* **ELEV.:**
BORING LOCATION: *See Boring Location Map, Figure 1* **START:** *03/26/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger* **FINISH:** *03/26/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▽ **:** *N/A* **CAVING -** ▰ **:** *N/A* **LOGGER:** *LW*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
			Stiff.			13.0
			Medium stiff.			13.1
			Stiff.			10.5
		SM	**SILTY SAND; light brown, damp, fine, cohesive.**			
			Medium dense.			8.6
		ML	**CLAYEY SILT; brown, moist, low plasticity**			
			Very stiff.			11.5

Figure Number 12

LOG OF TEST BORING
BORING B-11

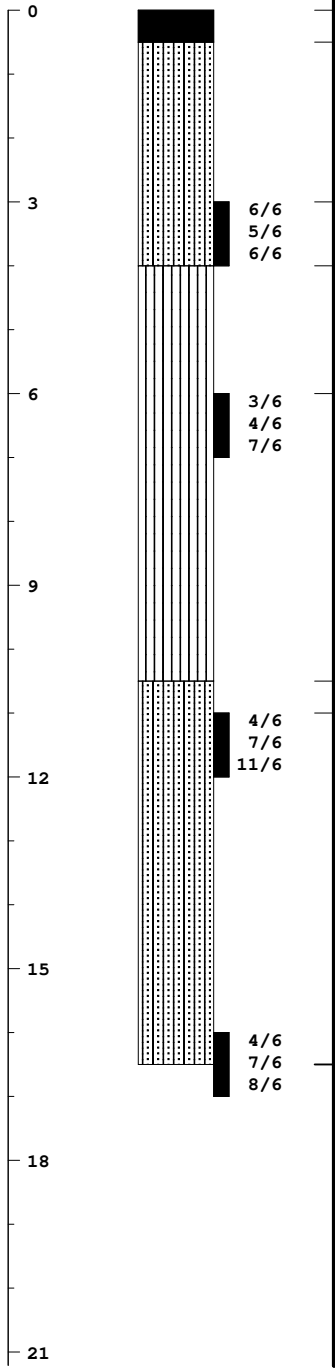
PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/26/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/26/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/26/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▽ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
45	8/6 11/6 11/6	CL	CLAY; yellowish brown, damp to moist, medium plasticity. Stiff.			16.3
48		SP	POORLY GRADED SAND; light brown, damp, fine to medium grained, traces of fine gravel.			
51	8/6 10/6 13/6		Medium dense.			2.6
			BOTTOM.			
54						
57						
60						
63						

Figure Number 12

LOG OF TEST BORING
BORING B-12

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SM	Approx. 6 inches of concrete with 1/8 inch wire mesh. SILTY SAND; dark brown, moist, cohesive.			
	6/6 5/6 6/6		Loose.		110.7	5.3
		ML	SANDY SILT; dark brown, moist.			
	3/6 4/6 7/6		Medium stiff.		116.0	11.8
		SM	SILTY SAND; light yellowish brown, moist, fine, cohesive.		119.0	7.5
	4/6 7/6 11/6		Medium dense.			
	4/6 7/6 8/6		BOTTOM.		102.0	5.0

Figure Number 13

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Paving
	Silty gravel
	Silty sand
	Silt
	Clayey sand
	Low plasticity clay
	Poorly graded sand
Misc. Symbols	
	Boring continues
Soil Samplers	
	California sampler
	Standard penetration test

Notes:

1. Eleven (11) exploratory borings were drilled between 03/20/2024 and 03/26/2024 using an 8-inch outside diameter hollow-stem auger.

2. No free groundwater was encountered to the maximum depth drilled of 16.5'.

3. Boring locations are shown on the Boring Location Map, Figure 1.

4. These logs are subject to the limitations, conclusions, and recommendations in this report.

5. Results of tests conducted on samples recovered are reported on the logs.

APPENDIX C

SOIL TEST DATA

SIEVE ANALYSES (ASTM D422 and/or ASTM D1140)

Grain size distributions for specimens retrieved from various subsurface elevations were tested to classify the materials. Test results are presented on Figures A-1 through A-3.

IN-SITU DENSITY & MOISTURE RELATIONSHIPS (ASTM D2216 & D2937)

Moisture & density data for undisturbed native soils was obtained by use of a 2-3/8-inch (inside diameter) split-barrel sampler. Test results are given on the Logs of Test Borings, Figures 2 through 12.

CONSOLIDATION TESTS (ASTM D2435)

Compressibility of soils was determined on saturated, undisturbed samples of native materials. Consolidation Test Diagrams, Figures B-1 through B-4, graphically express the relationship of vertical strain vs. applied vertical (normal) load for earth materials selected as most representative of the soil strata within the anticipated zone of influence of foundation loads.

DIRECT SHEAR TESTS (ASTM D3080)

Quick-consolidated direct shear tests were performed on an undisturbed, saturated sample of native earth materials. This test provides information on soil shear strength vs. normal load and is used to determine the angle of internal friction and cohesion of earth materials under essentially drained conditions. Test results are presented on Figures C-1 through C-6.

EXPANSION INDEX (ASTM D4829)

The Expansion Index test is designed to measure a basic index property of soil and in this respect is comparable to other index tests such as the Atterberg Limits. In formulating the test procedures, no attempt has been made to duplicate any particular moisture or loading conditions which may occur in the field. Rather, an attempt has been made to control all variables which influence the expansive characteristics of a particular soil and still retain a practical test for general engineering usage. Near surface soils were obtained and tested for expansiveness. Test results are presented on the Laboratory Testing Recap, Table 1.

R-VALUE TESTS (CTM-301)

R-Value tests were performed to obtain flexible pavement design data. Test results are presented on Figures D-1 and D-2.

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SOIL CORROSIVITY (SO_4 / pH / Chlorides)

Tests for Soluble Sulfates (SO_4), Soluble Chlorides (Cl), and pH values were performed on two (2) composite samples retrieved from the upper 3 feet to determine the corrosion potential of the soils. Corrosion prevention measures and the extent to which measures should be taken (if any) should be addressed with the corrosion engineer. Soluble Sulfates and Soluble Chlorides values were determined according to EPA 300.0M. The pH values were determined according to EPA Method 9045C. Results of all the constituents are discussed in the Soil Corrosivity section.

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College of the Sequoias

Geotechnical Engineering Services
615 S. Mooney Blvd, Visalia, CA 93277
University Center & Student Union Buildings

SEI File No. 24-19596
May 8, 2024

TABLE 1

TEST LOCATION	USCS	% < # 200	CONSOLIDATION				DIRECT SHEAR		UNCONFINED COMPRESSION		E.I.	MINIMUM RESISITIVITY	ATTERBERG LIMITS			R-VALUE @ 300 psi		MAXIMUM DENSITY	
			C_C	C_S	S.P. (psf)	HV %	C, (ksf)	F.A.	Q_U, (psi)	C, (ksf)			LL	PL	PI	R.V.	E.P. (psi)	MDD (pcf)	O.M.
B-6 @ 3'	SM						0.22	32.6											
B-6 @ 6'	SM		0.04	0.01	0	-0.2													
B-6 @ 11'	SM						0.49	35.9											
B-7 @ 3'	SM						0.59	45											
B-7 @ 6'	ML		0.18	0.02	0	-0.3													
B-7 @ 11'	SM						0.15	44											
B-10 @ 0-5'	SM	33									0								
B-10 @ 3'	SM						0.46	37											
B-10 @ 6'	ML		0.02	0.01	0	-0.2													
R-1 @ 0-5'	SP-SM	9.4														67	0		
R-2 @ 0-5'	SC	42														28	0.14		

CONSOLIDATION
Cc - Compression Index
Cs - Swell Index
S.P. (psf) - Swell Pressure
HV % - Heave Percentage / Collapse

UNCONFINED COMPRESSION
Q_U (psi) - Unconfined Compression Strength
C, (ksf) - Cohesion

DIRECT SHEAR
C (ksf) - Cohesion
F.A. - Friction Angle

E.I. - EXPANSION INDEX

ATTERBERG LIMITS
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index

RESISTANCE VALUE (R-VALUE)
RV - R-Value @ 300 psi
EP - Expansion Press @ 300 psi

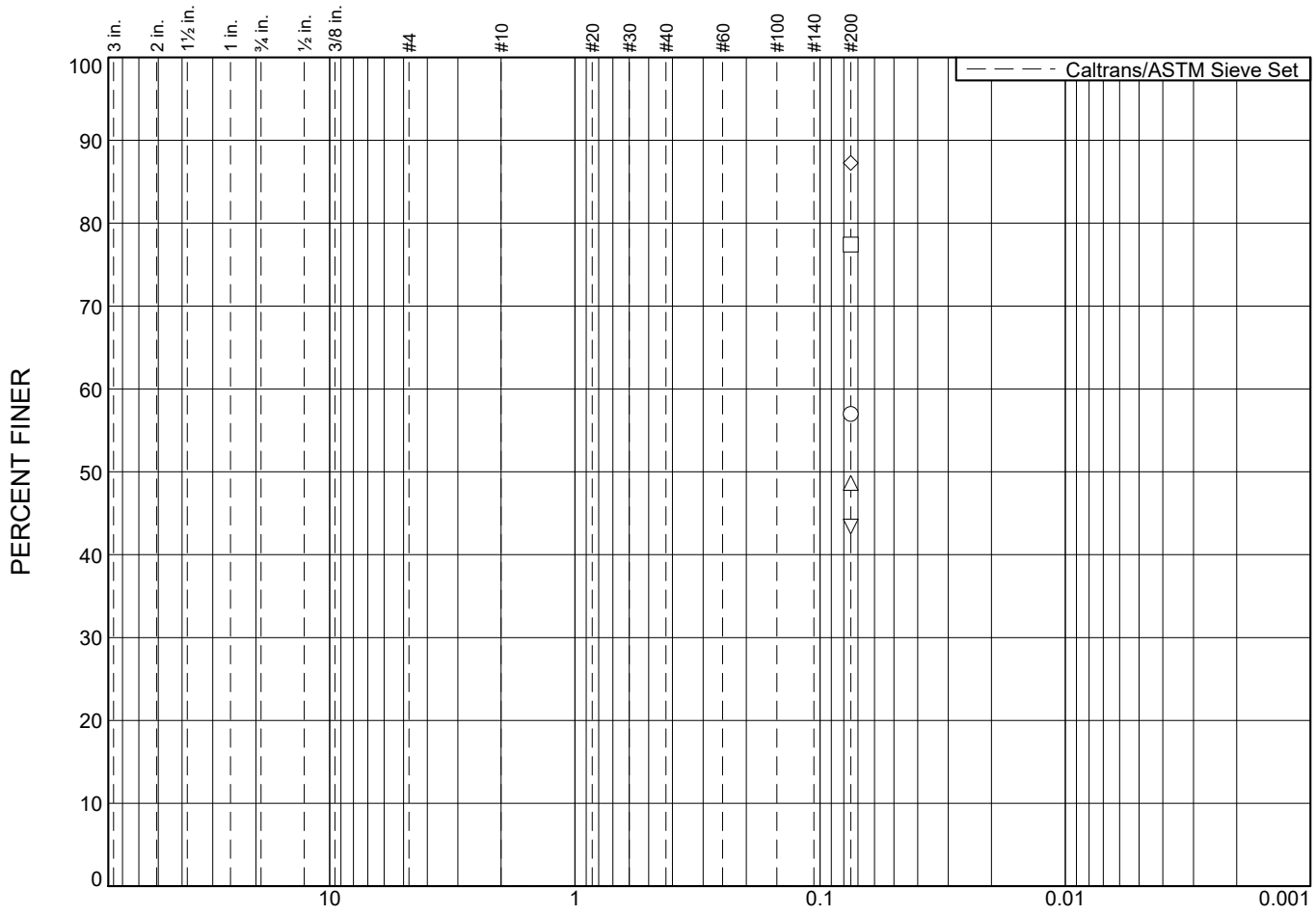
MINIMUM RESISITIVITY - (ohm-cm)

MAXIMUM DENSITY
MDD (pcf) - Max Dry Density
O.M. - Optimum Moisture

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							57	
□							77	
△							49	
◇							87	
▽							43	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-3		11'	SANDY SILT	ML
□	B-3		16'	SANDY SILT	ML
△	B-3		21'	CLAYEY SAND	SC
◇	B-3		26'	SANDY CLAY	CL
▽	B-3		31'	SILTY SAND	SM

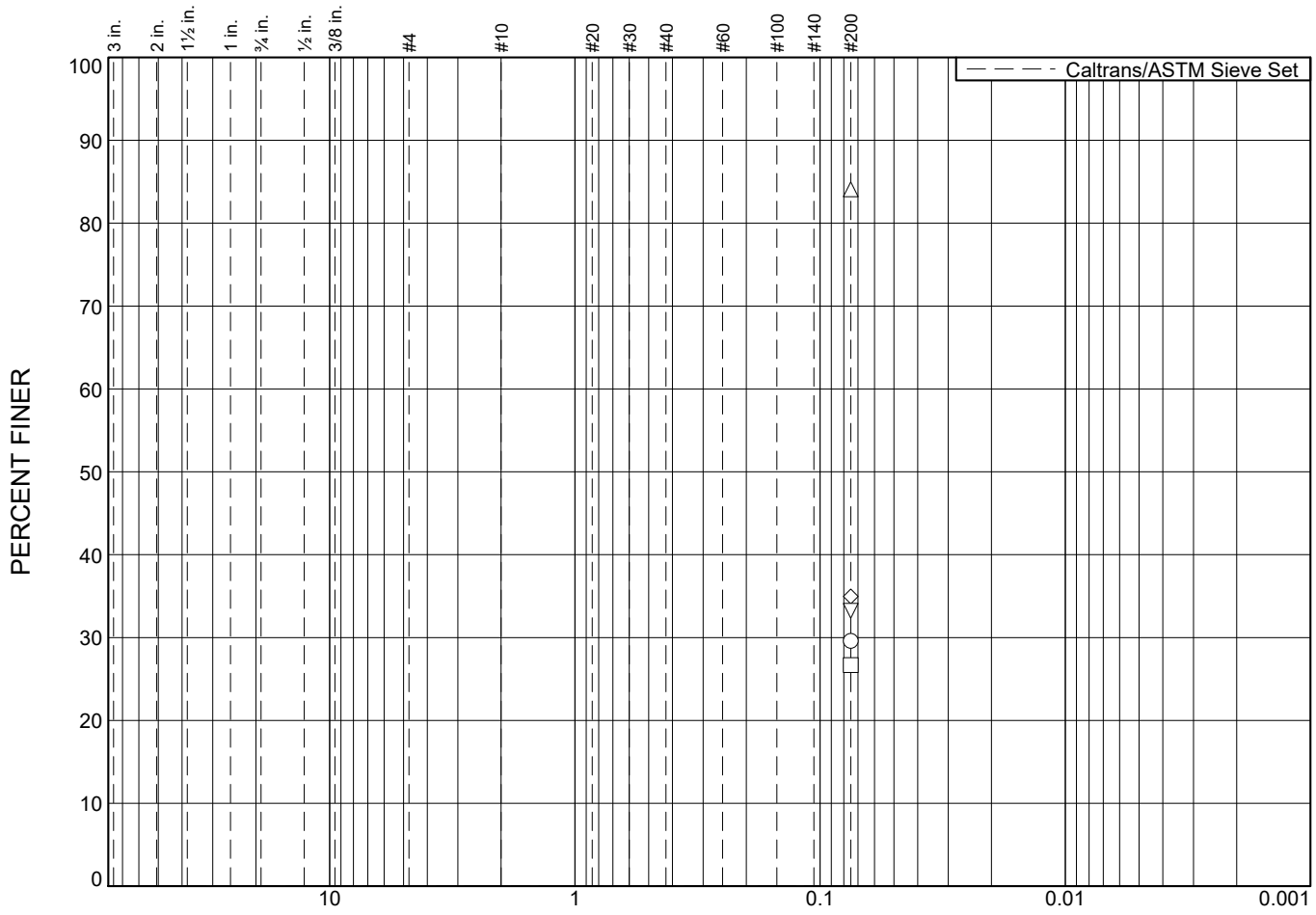
SOILS ENGINEERING, INC.

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Project No.: 19596 **Figure** A-1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							30	
□							27	
△							84	
◇							35	
▽							33	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-3		36'	POORLY GRADED SAND	SP
□	B-3		41'	SILTY SAND	SM
△	B-3		46'	SANDY SILT	ML
◇			0-5'	SILTY SAND (B-6)	SM
▽			0-5'	SILTY SAND (B-10)	SM

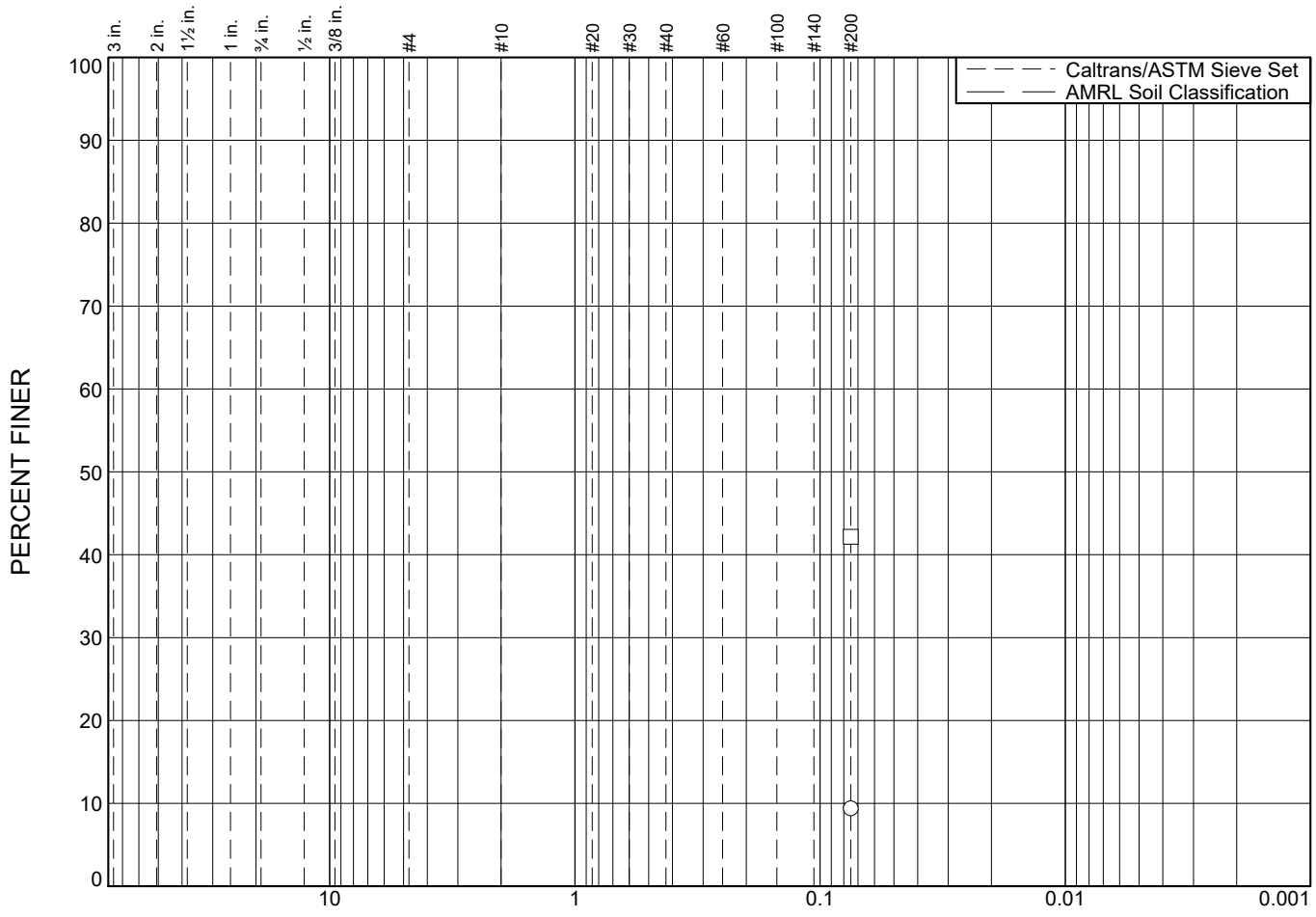
SOILS ENGINEERING, INC.

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Project No.: 19596 **Figure** A-2

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							9.4	
□							42.2	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		94019	0-5'	POORLY GRADED SAND with silt (R-1 @ 0-5')	SP-SM
□		94020	0-5'	CLAYEY SAND (R-2 @ 0-5')	SC

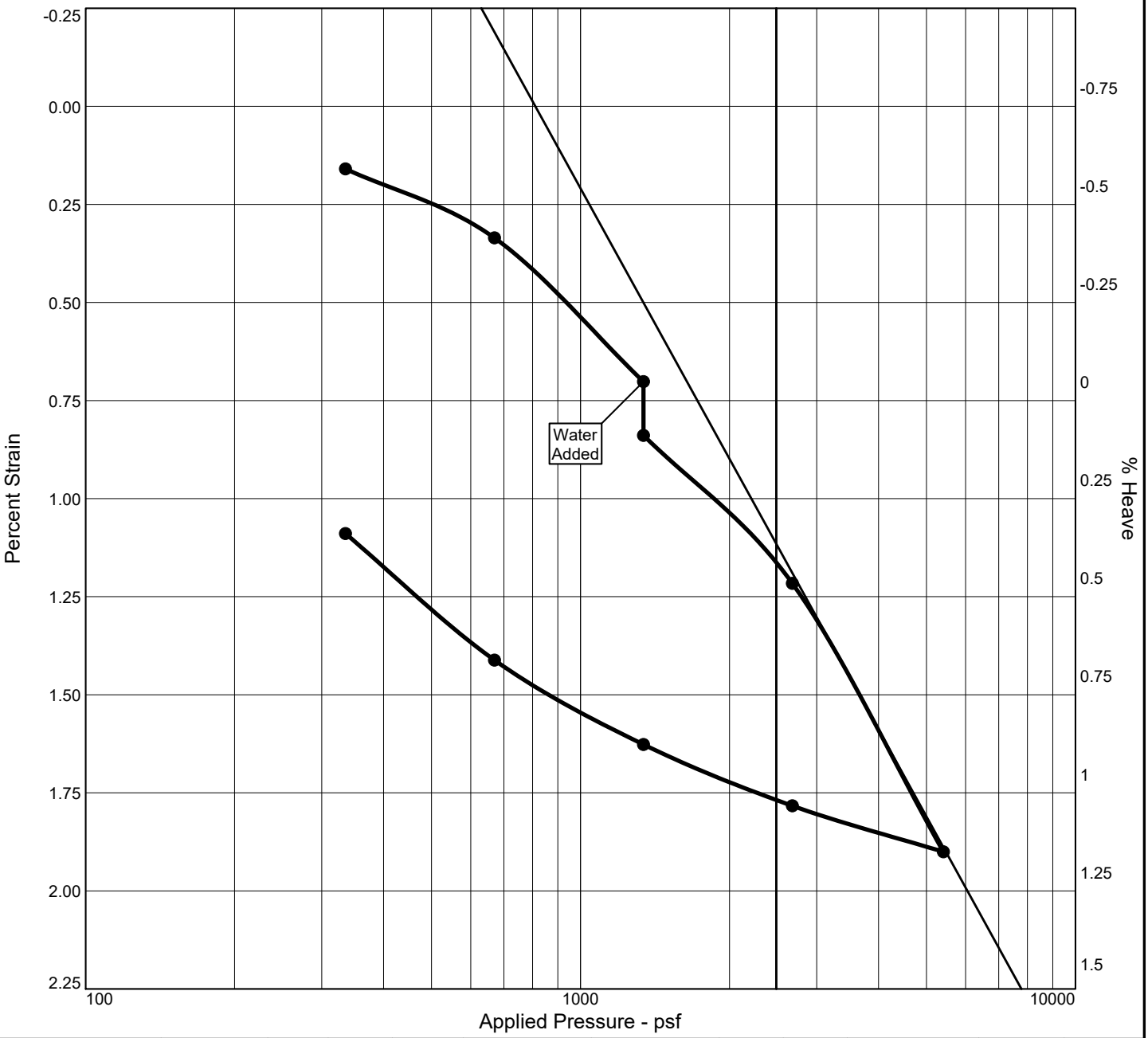
SOILS ENGINEERING, INC.

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Project No.: 19596 **Figure** A-3

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
78.6 %	17.7 %	103.5	N/A	N/A	2.65	336	2671	0.04	0.01		-0.1	0.598

MATERIAL DESCRIPTION	USCS	AASHTO
CLAYEY SAND	SC	

Project No. 19596 **Client:** College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-2 **Depth:** 6'

Remarks:

Test Date: 04/11/24

Sample No.: 93964

SOILS ENGINEERING, INC.

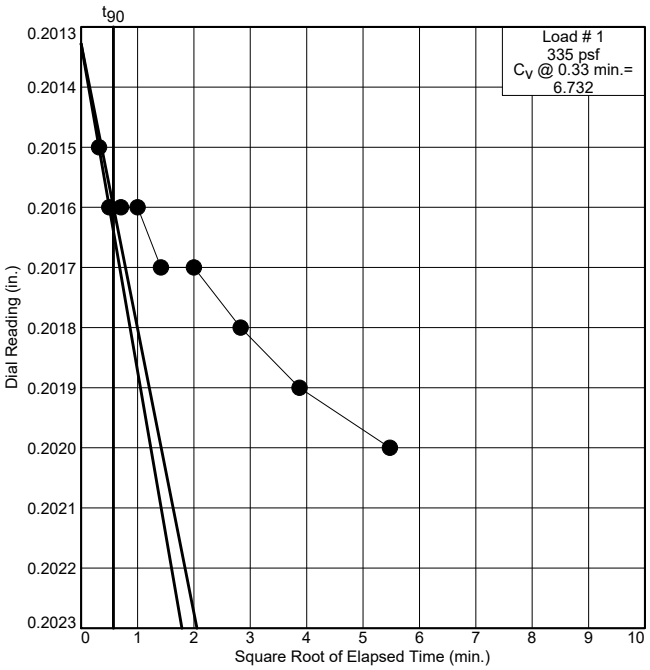
Figure B-1

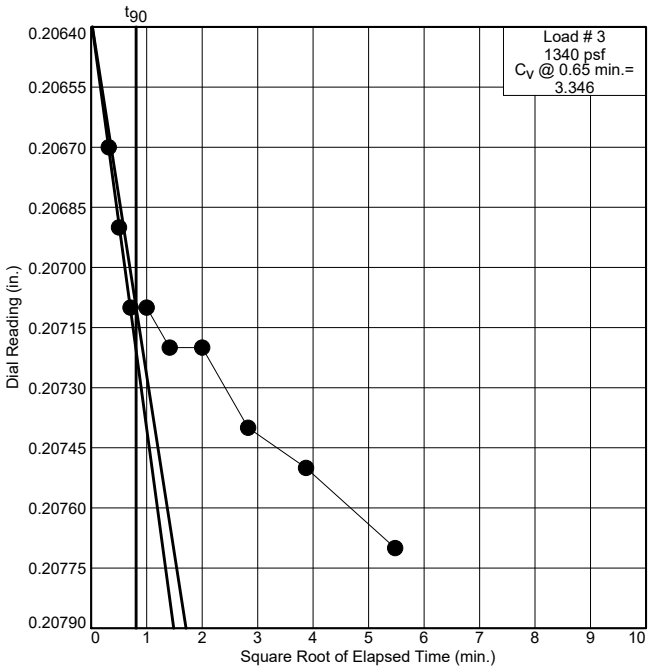
Tested By: RG **Checked By:** AL

Dial Reading vs. Time

Project No.: 19596
Project: University Center & Student Union Buildings

Source of Sample: B-2 Depth: 6'

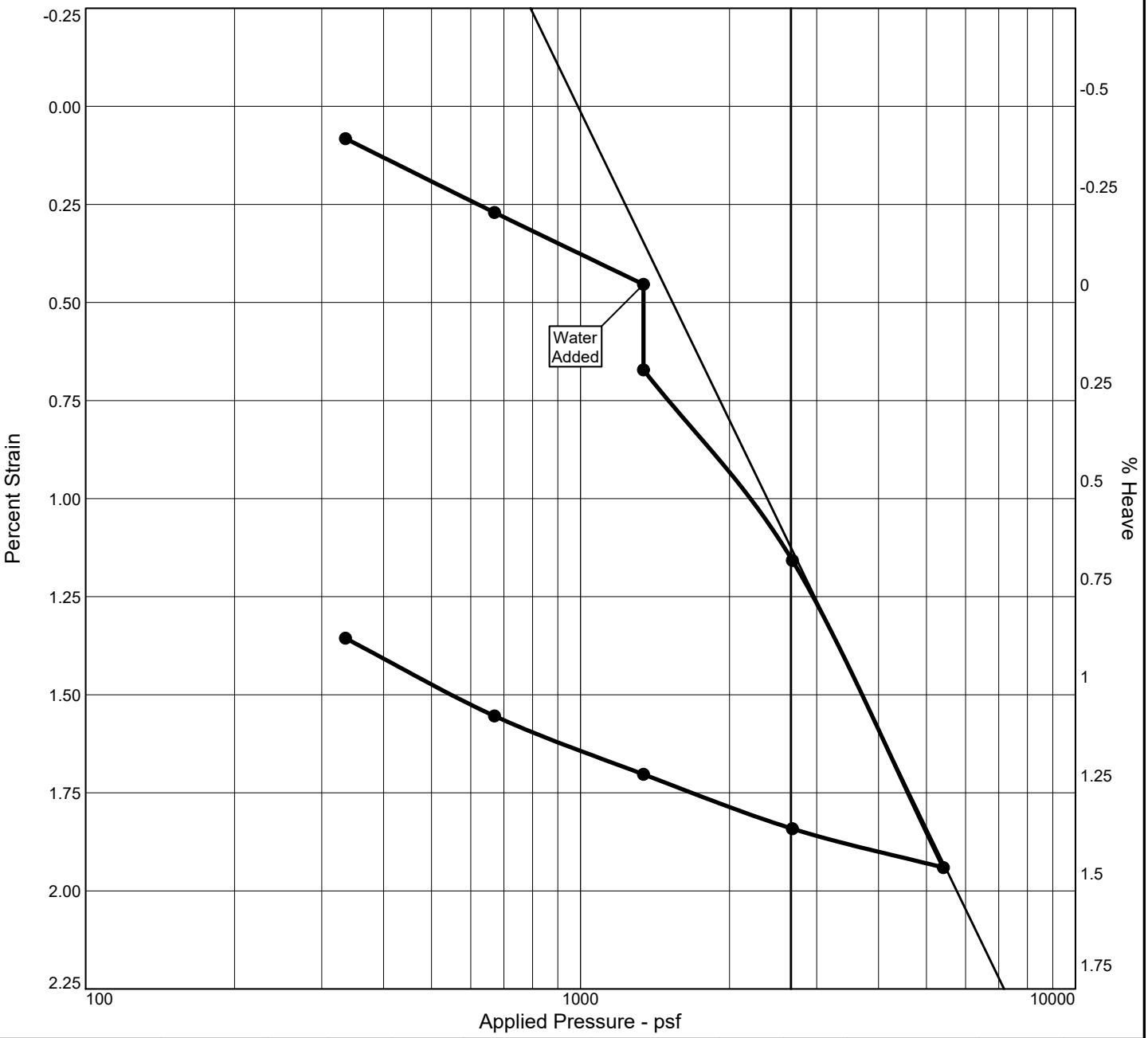




SOILS ENGINEERING, INC.

Figure B-1

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
57.2 %	12.2 %	105.7	N/A	N/A	2.65	336	2768	0.04	0.01		-0.2	0.564

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND	SM	

Project No. 19596 **Client:** College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-6 **Depth:** 6'

Remarks:

Test Date: 04/11/24

Sample No.: 93988

SOILS ENGINEERING, INC.

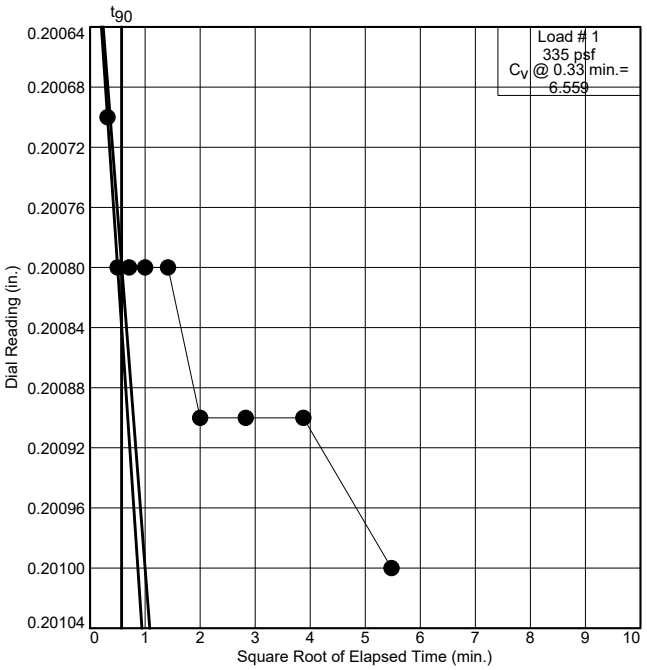
Figure B-2

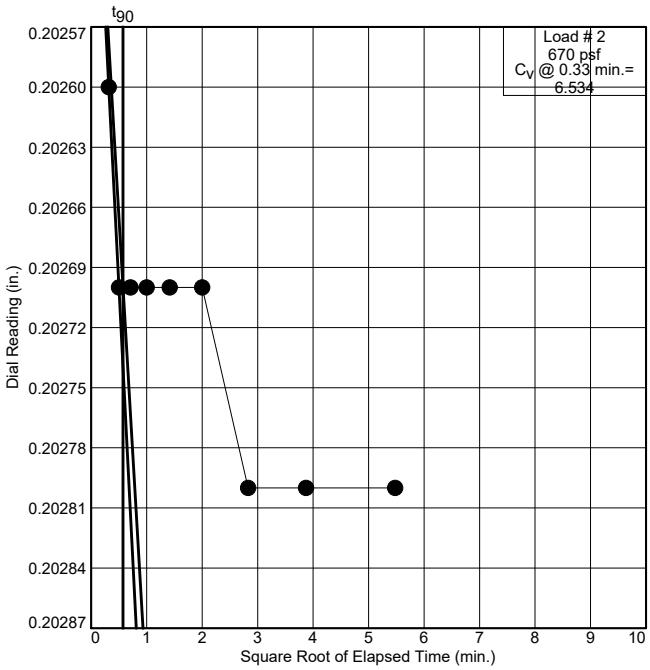
Tested By: RG **Checked By:** AL

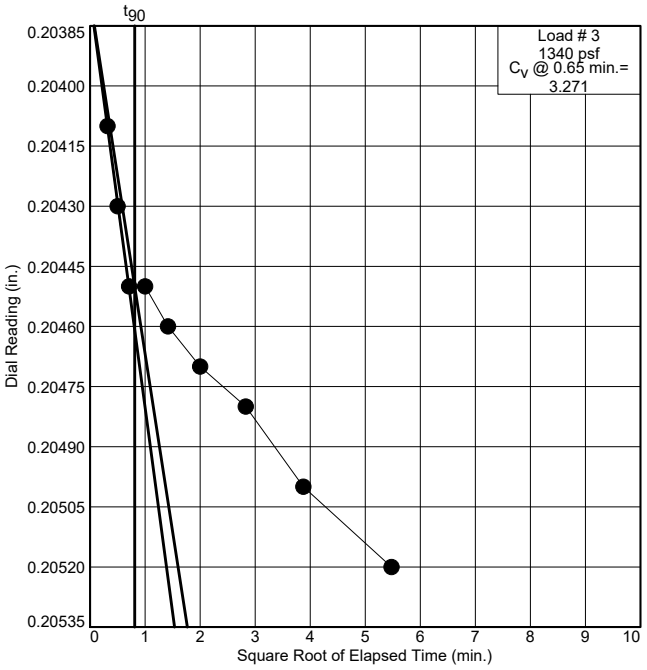
Dial Reading vs. Time

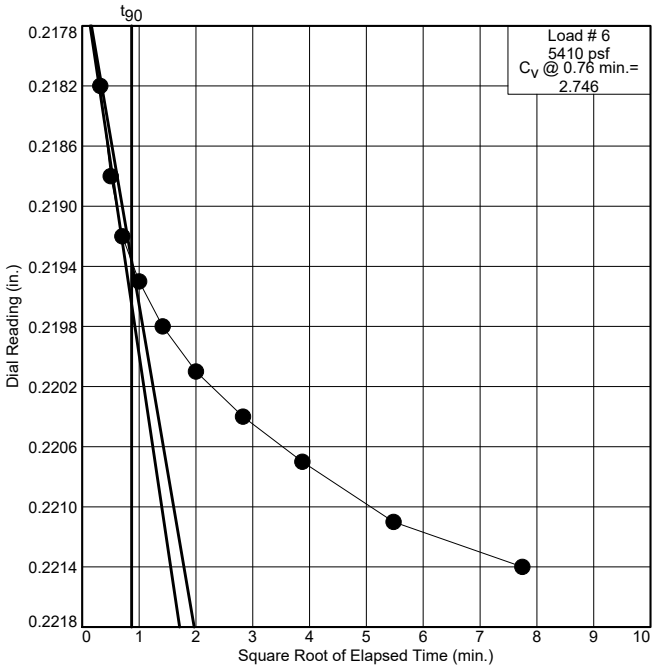
Project No.: 19596
Project: University Center & Student Union Buildings

Source of Sample: B-6 Depth: 6'





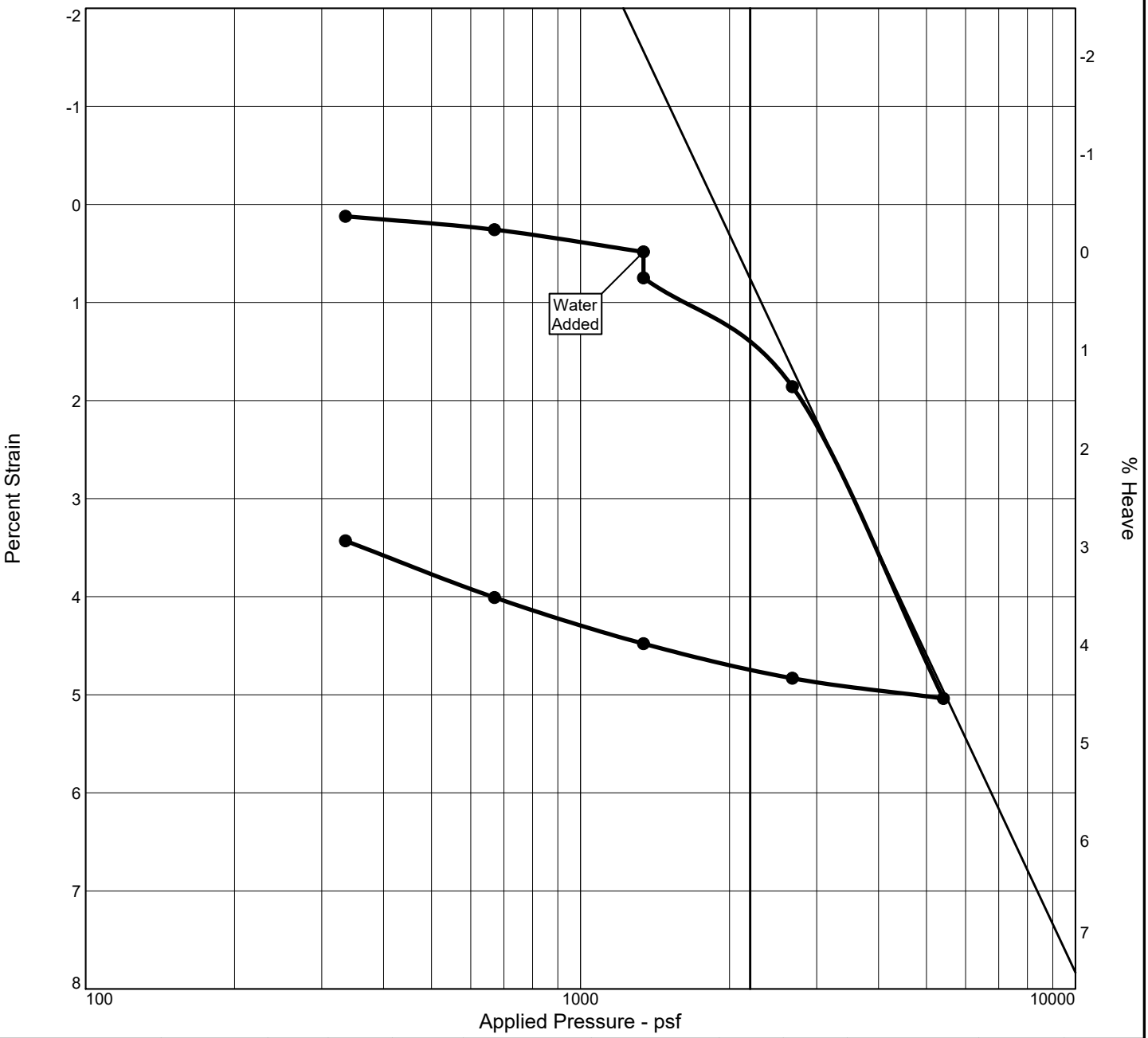




SOILS ENGINEERING, INC.

Figure B-2

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
42.5 %	11.3 %	97.2	N/A	N/A	2.65	336	2599	0.18	0.02		-0.3	0.702

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY SILT	ML	

Project No. 19596 **Client:** College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-7 **Depth:** 6'

Remarks:

Test Date: 04/11/24

Sample No.: 93992

SOILS ENGINEERING, INC.

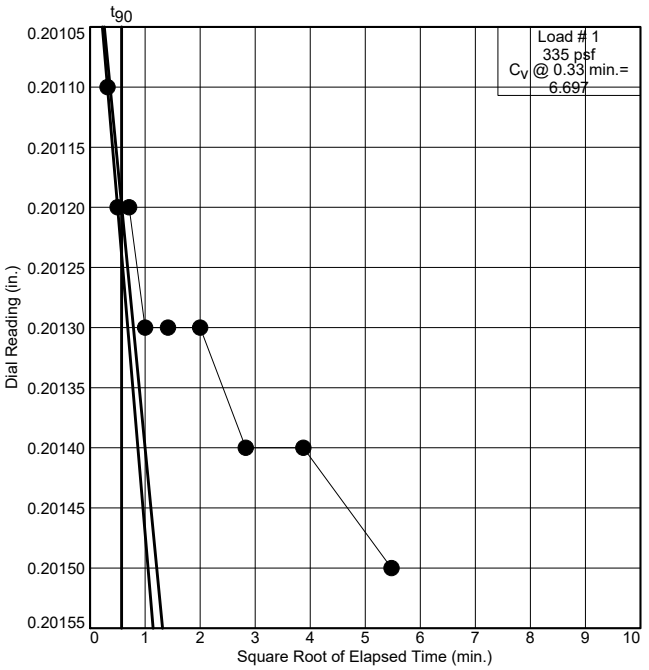
Figure B-3

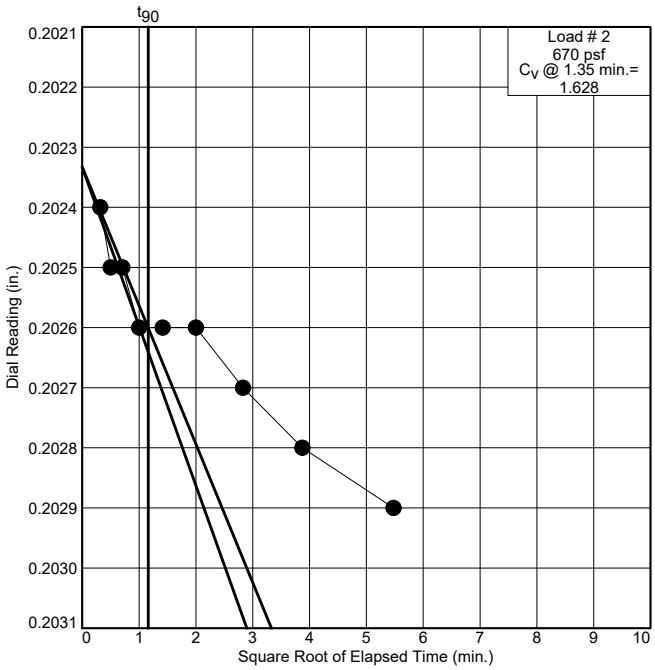
Tested By: RG **Checked By:** AL

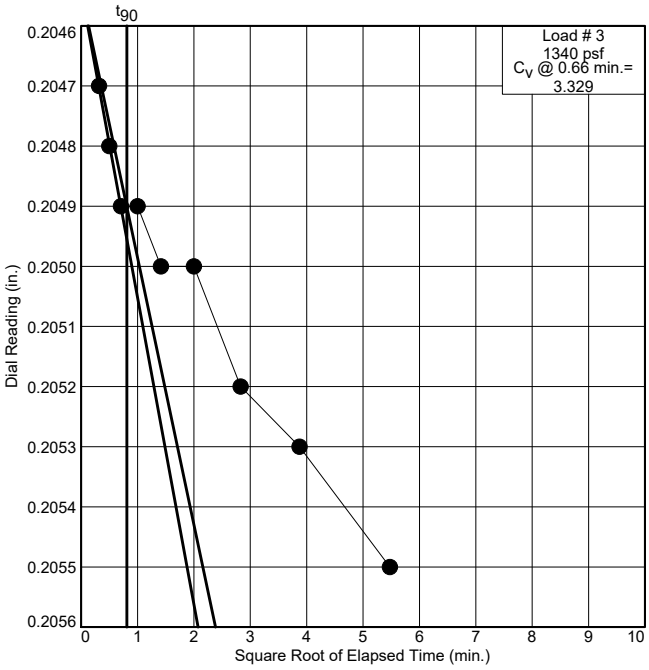
Dial Reading vs. Time

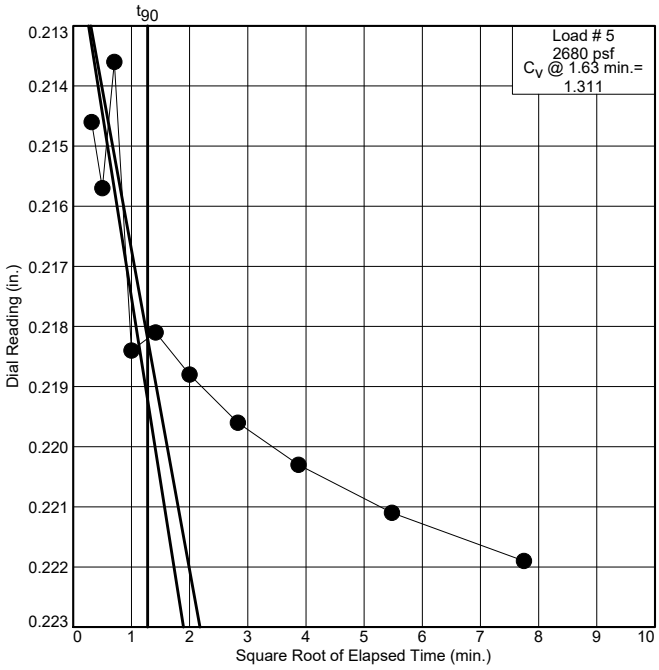
Project No.: 19596
Project: University Center & Student Union Buildings

Source of Sample: B-7 Depth: 6'









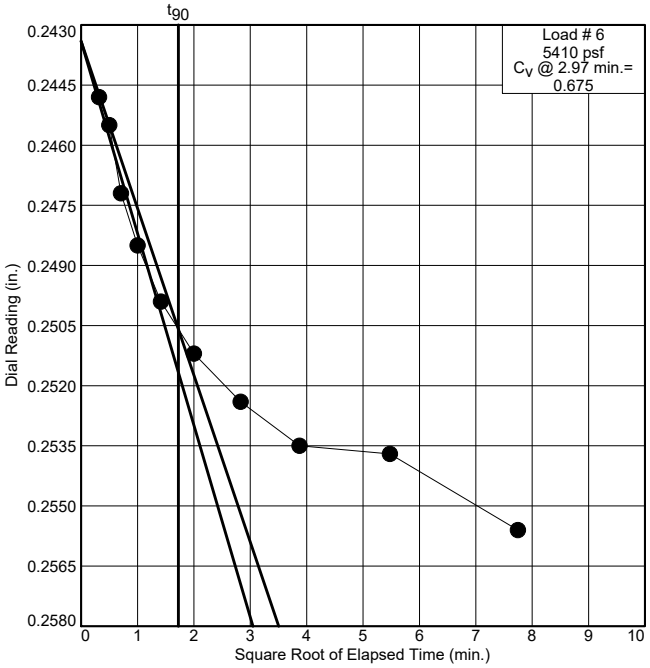
SOILS ENGINEERING, INC.

Figure B-3

Dial Reading vs. Time

Project No.: 19596
Project: University Center & Student Union Buildings

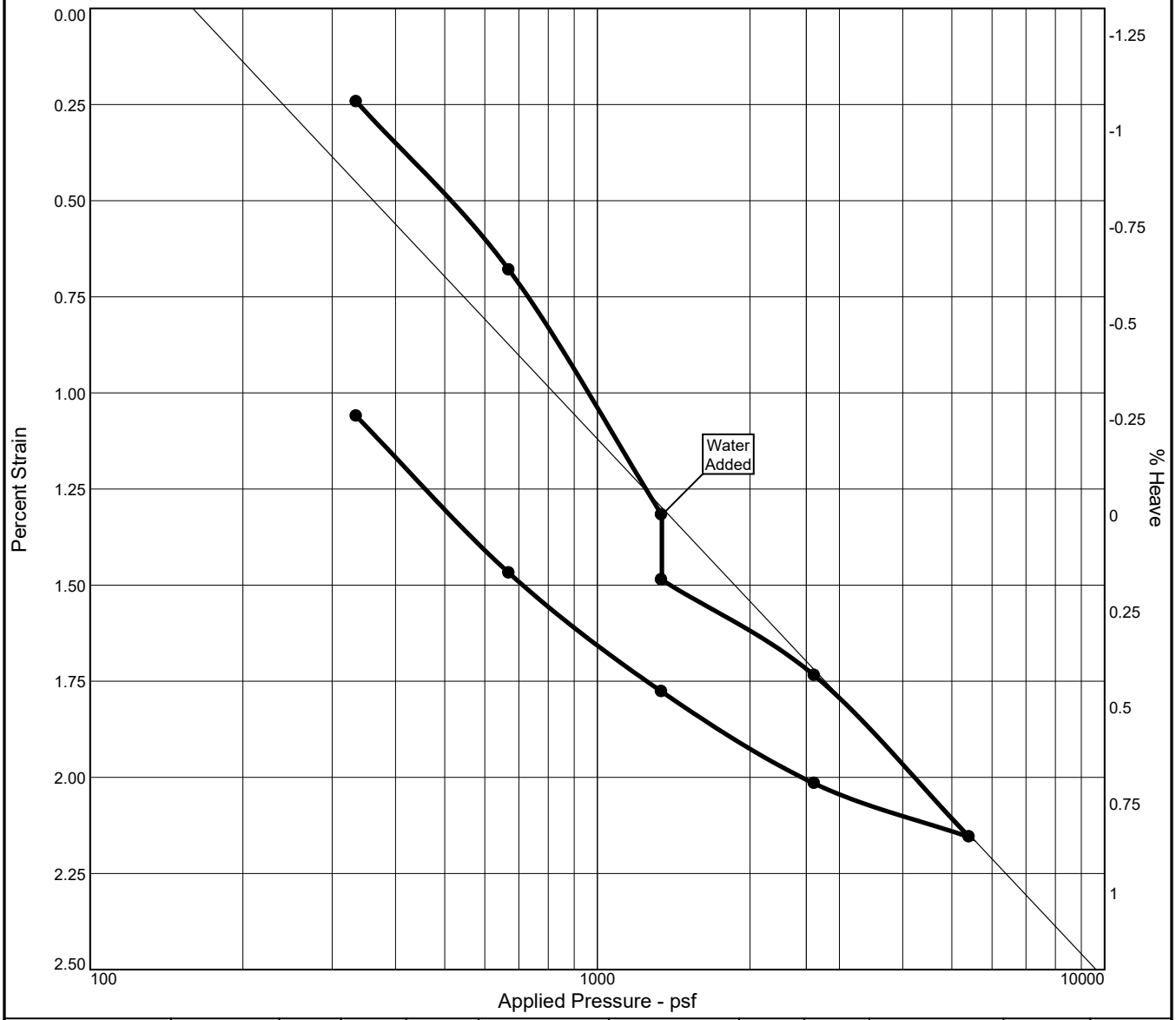
Source of Sample: B-7 Depth: 6'



SOILS ENGINEERING, INC.

Figure B-3

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
79.9 %	16.8 %	106.3	N/A	N/A	2.65	336	2720	0.02	0.01		-0.2	0.556

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY SILT	ML	N/A

Project No. 19596 **Client:** College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-10 **Depth:** 6'

Remarks:
Test Date: 04/11/24
Sample No.: 94000

SOILS ENGINEERING, INC.

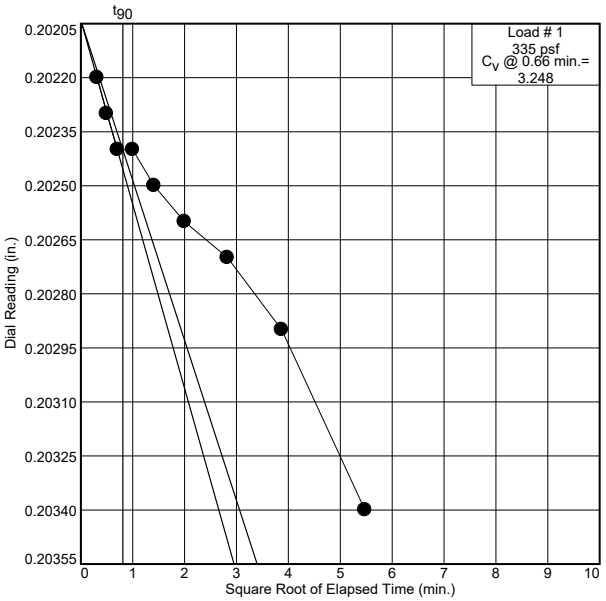
Figure B-4

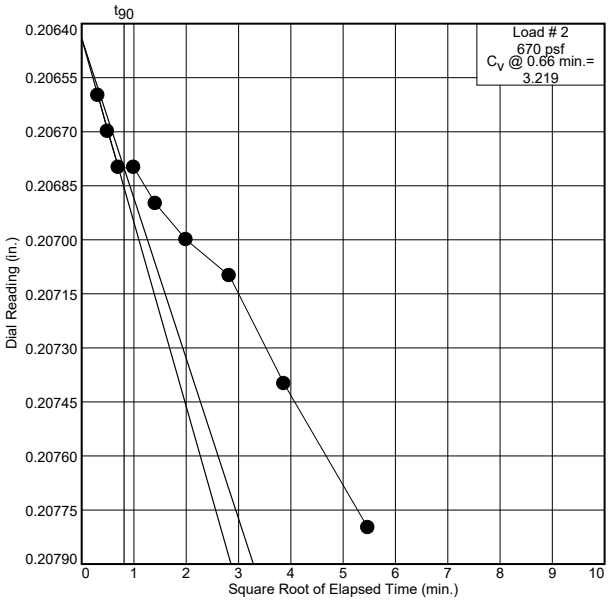
Tested By: RG **Checked By:** AL

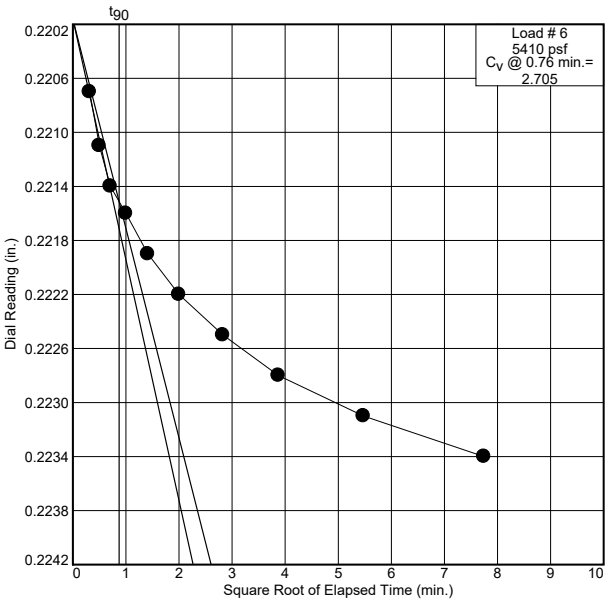
Dial Reading vs. Time

Project No.: 19596
Project: University Center & Student Union Buildings

Source of Sample: B-10 Depth: 6'

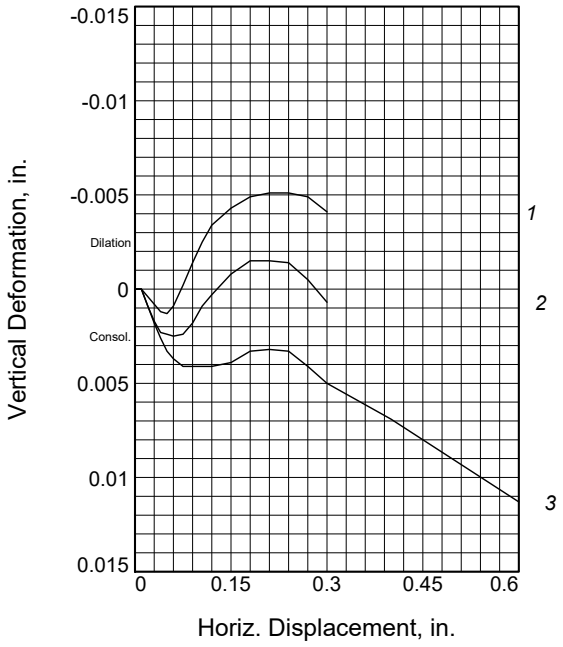


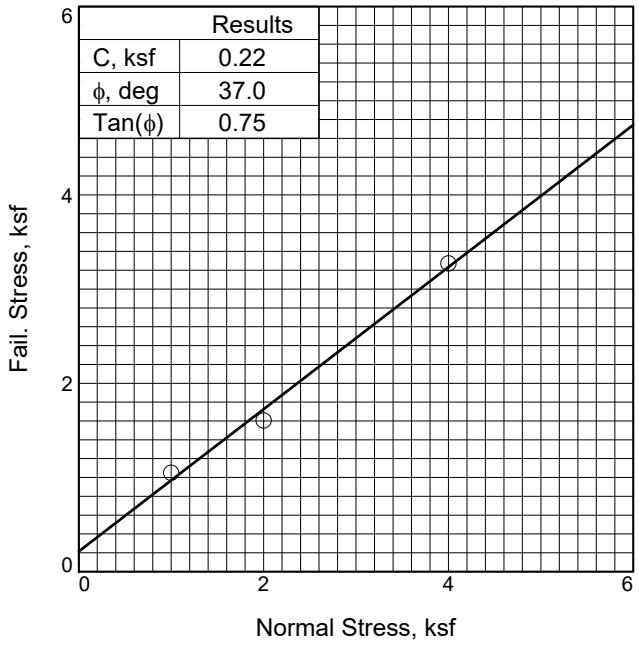


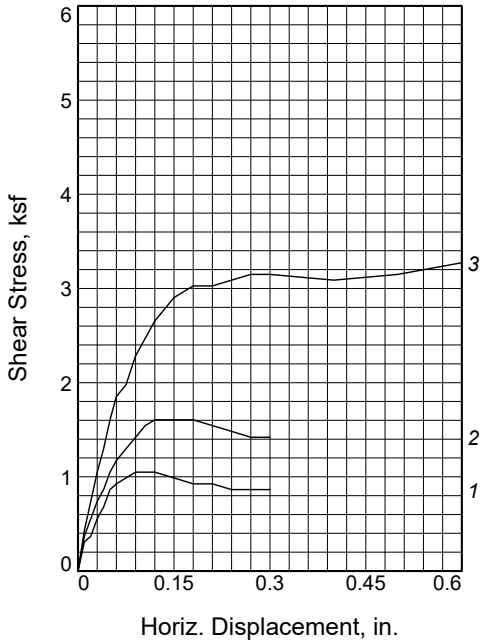


SOILS ENGINEERING, INC.

Figure B-4







Sample No.		1	2	3
Initial	Water Content, %	16.6	16.2	16.2
	Dry Density, pcf	99.1	104.3	105.3
	Saturation, %	65.7	73.4	75.0
	Void Ratio	0.6685	0.5860	0.5717
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	20.4	20.9	17.6
	Dry Density, pcf	99.1	104.3	105.3
	Saturation, %	80.8	94.3	81.8
	Void Ratio	0.6685	0.5860	0.5717
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		1.05	1.61	3.27
Displacement, in.		0.09	0.12	0.60
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE

Description: SILTY SAND; dark yellowish brown, damp, cohesive.

LL= N/A **PI=** N/A

Assumed Specific Gravity= 2.65

Remarks: Test Date: 04/24/24

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-2 **Depth:** 3'

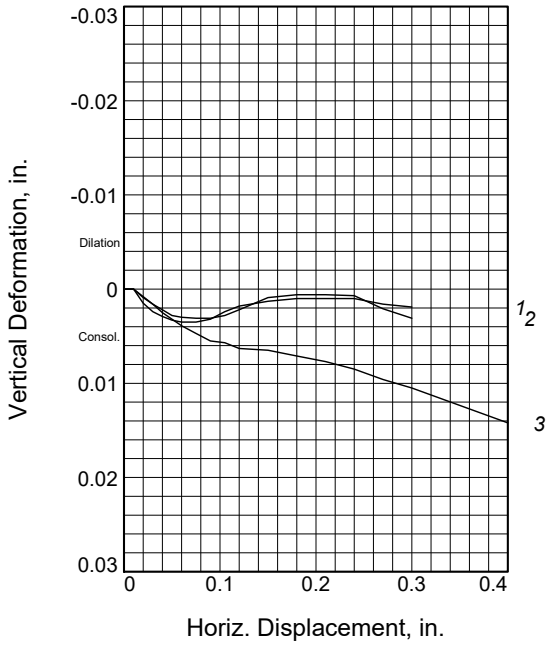
Proj. No.: 19596 **Date Sampled:** 03/20/24

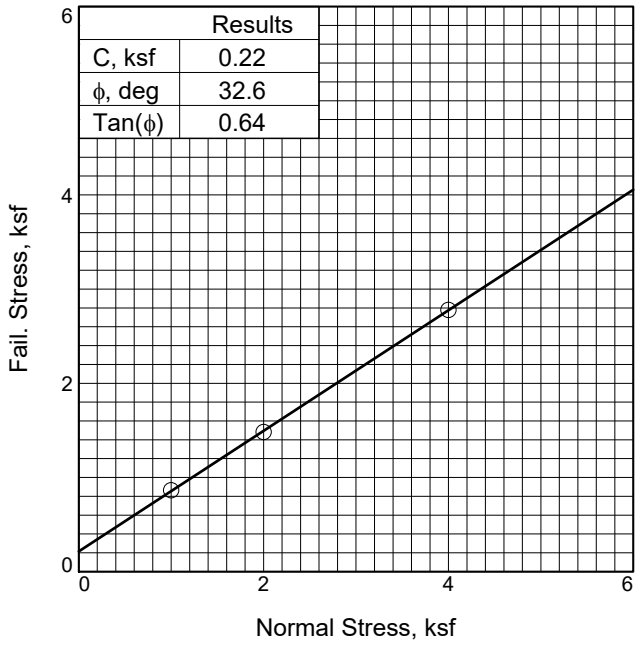
DIRECT SHEAR TEST REPORT

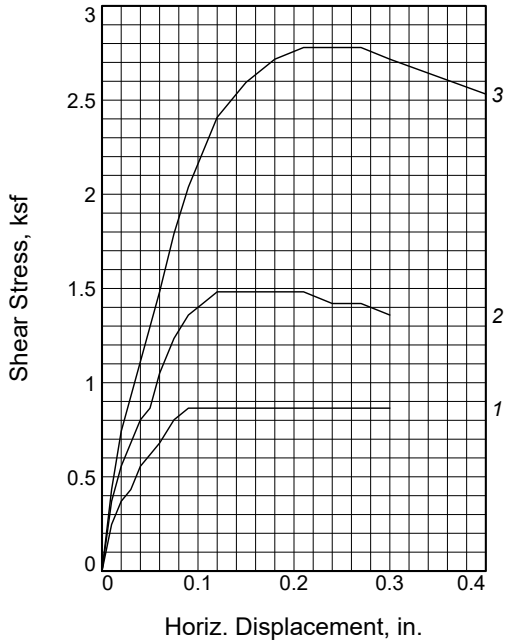
SOILS ENGINEERING, INC.

Figure C-1

Tested By: SC **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	17.9	22.1	20.4
	Dry Density, pcf	93.7	93.4	95.0
	Saturation, %	62.0	75.9	72.8
	Void Ratio	0.7650	0.7715	0.7410
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	25.3	25.2	21.4
	Dry Density, pcf	93.7	93.4	95.0
	Saturation, %	87.7	86.7	76.4
	Void Ratio	0.7650	0.7715	0.7410
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		0.86	1.48	2.78
Displacement, in.		0.09	0.12	0.21
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE
Description: SILTY SAND; dark brown, damp, cohesive, traces of organics.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 04/24/24

Figure C-2

Client: College of the Sequoias

Project: University Center & Student Union Buildings

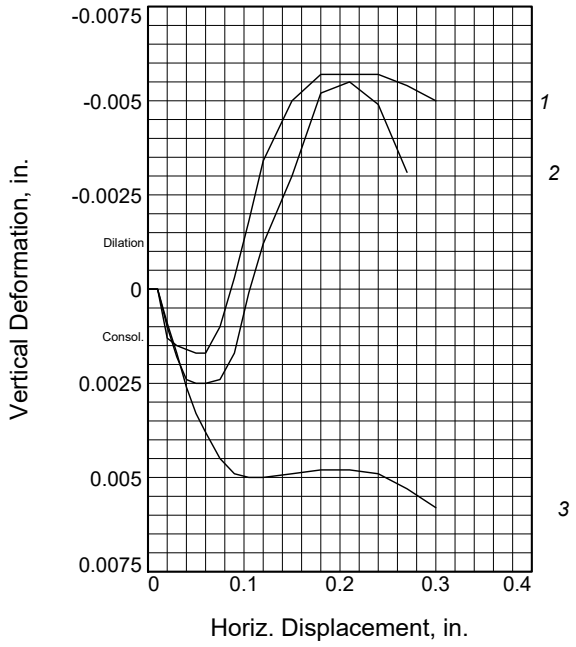
Source of Sample: B-6 **Depth:** 3'

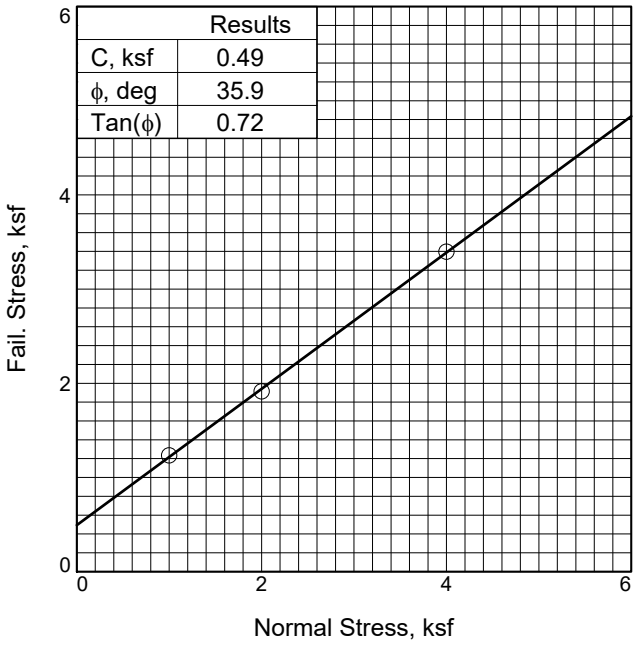
Proj. No.: 19596 **Date Sampled:** 03/25/24

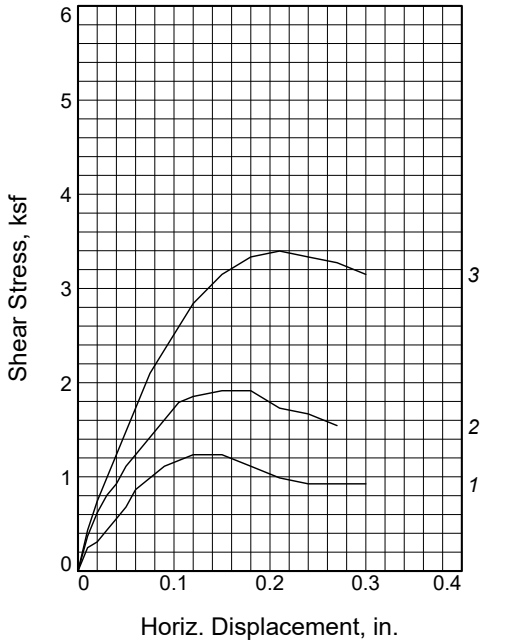
DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: SC **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	16.7	17.8	18.3
	Dry Density, pcf	109.9	111.2	110.2
	Saturation, %	87.4	96.6	96.5
	Void Ratio	0.5053	0.4879	0.5018
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	18.6	18.3	17.9
	Dry Density, pcf	109.9	111.2	110.2
	Saturation, %	97.7	99.1	94.4
	Void Ratio	0.5053	0.4879	0.5018
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		1.24	1.91	3.40
Displacement, in.		0.12	0.15	0.21
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE
Description: SILTY SAND; dark brown, damp, cohesive.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 04/24/24

Figure C-3

Client: College of the Sequoias

Project: University Center & Student Union Buildings

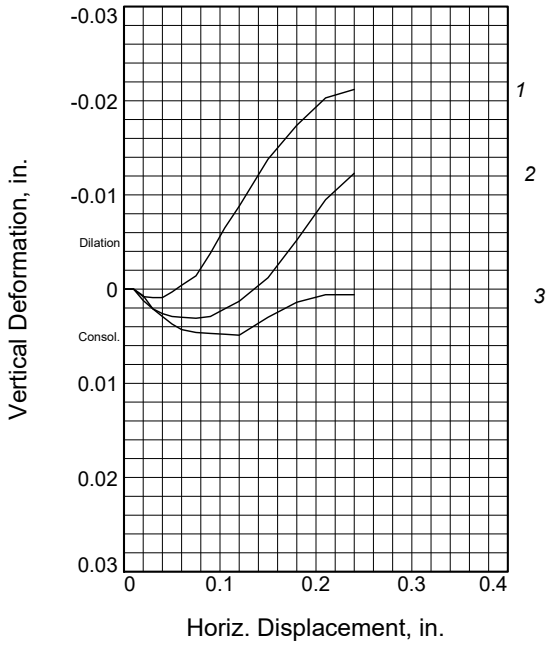
Source of Sample: B-6 **Depth:** 11'

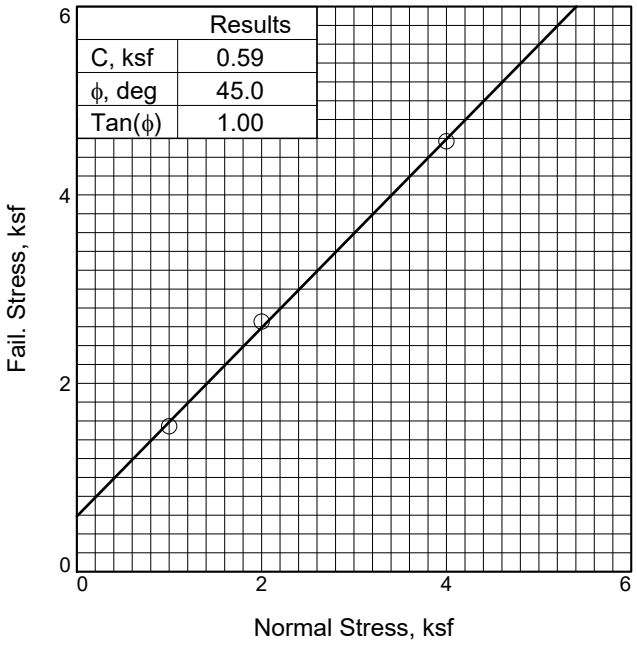
Proj. No.: 19596 **Date Sampled:** 03/25/24

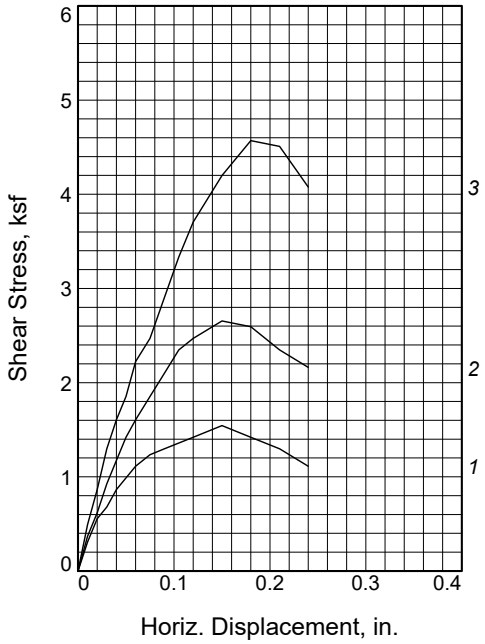
DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: SC **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	19.6	19.0	17.5
	Dry Density, pcf	92.5	98.5	101.5
	Saturation, %	66.0	74.2	73.4
	Void Ratio	0.7879	0.6802	0.6304
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	26.5	22.6	18.8
	Dry Density, pcf	92.5	98.5	101.5
	Saturation, %	89.1	88.1	79.1
	Void Ratio	0.7879	0.6802	0.6304
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		1.54	2.66	4.57
Displacement, in.		0.15	0.15	0.18
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE
Description: SILTY SAND; dark brown, damp, with low plasticity clay.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 04/24/24

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-7 **Depth:** 3'

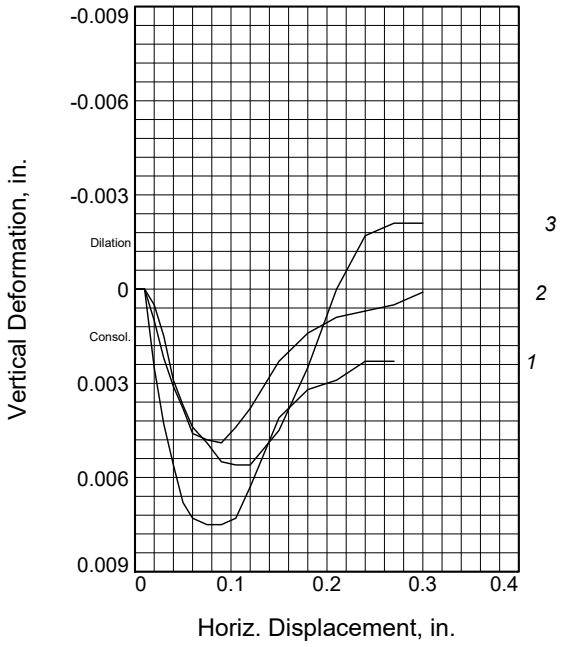
Proj. No.: 19596 **Date Sampled:** 03/25/24

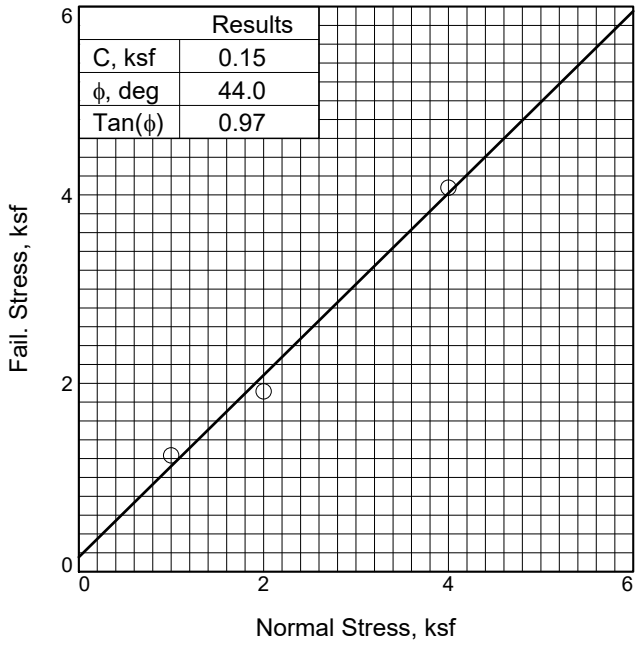
DIRECT SHEAR TEST REPORT

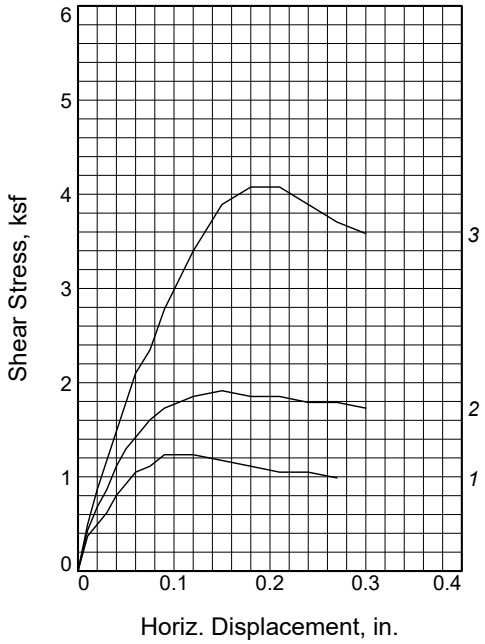
SOILS ENGINEERING, INC.

Figure C-4

Tested By: SC **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	6.2	6.3	5.4
	Dry Density, pcf	104.8	108.7	110.7
	Saturation, %	28.2	32.1	29.1
	Void Ratio	0.5782	0.5220	0.4948
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	18.6	17.1	15.4
	Dry Density, pcf	104.8	108.7	110.7
	Saturation, %	85.3	86.8	82.4
	Void Ratio	0.5782	0.5220	0.4948
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		1.24	1.91	4.08
Displacement, in.		0.09	0.15	0.18
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE
Description: SILTY SAND; dark yellowish brown, dry, cohesive.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 04/26/24

Figure C-5

Client: College of the Sequoias

Project: University Center & Student Union Buildings

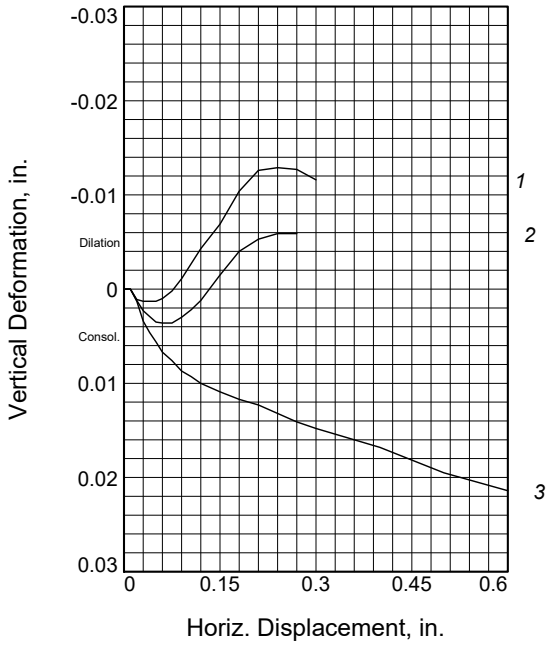
Source of Sample: B-7 **Depth:** 11'

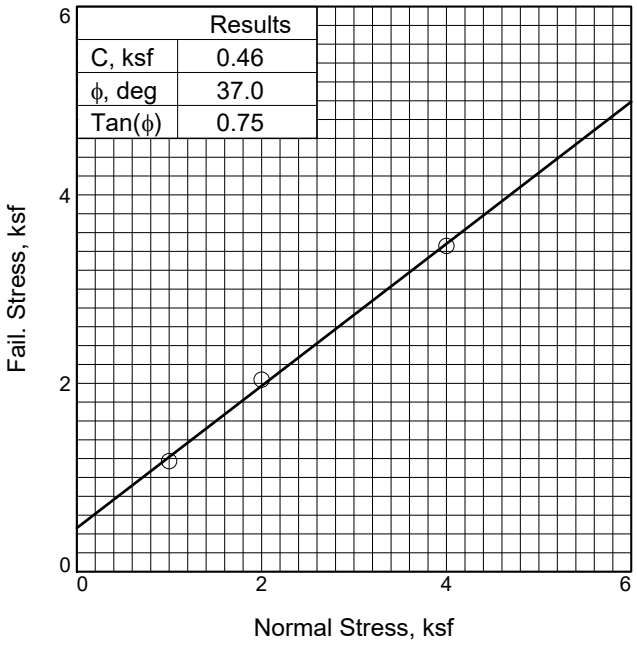
Proj. No.: 19596 **Date Sampled:** 03/25/24

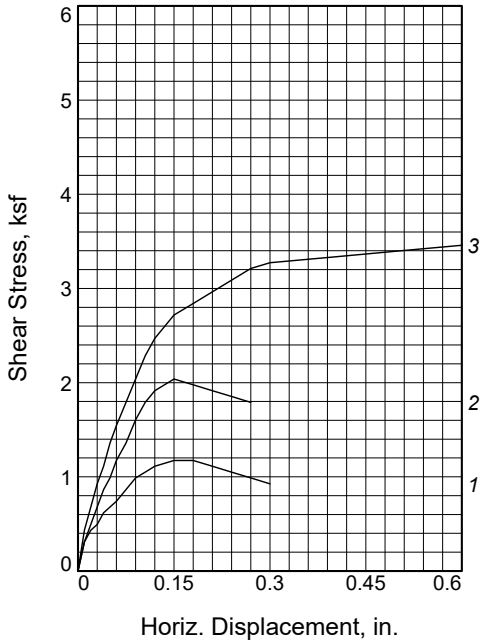
DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: SC **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	16.1	11.5	11.6
	Dry Density, pcf	107.2	111.4	109.9
	Saturation, %	78.7	62.8	60.7
	Void Ratio	0.5428	0.4856	0.5053
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	19.0	15.8	16.7
	Dry Density, pcf	107.2	111.4	109.9
	Saturation, %	92.8	86.0	87.4
	Void Ratio	0.5428	0.4856	0.5053
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		1.17	2.04	3.46
Displacement, in.		0.15	0.15	0.60
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE
Description: SILTY SAND; dark brown, damp, cohesive.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 04/25/24

Figure C-6

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-10 **Depth:** 3'

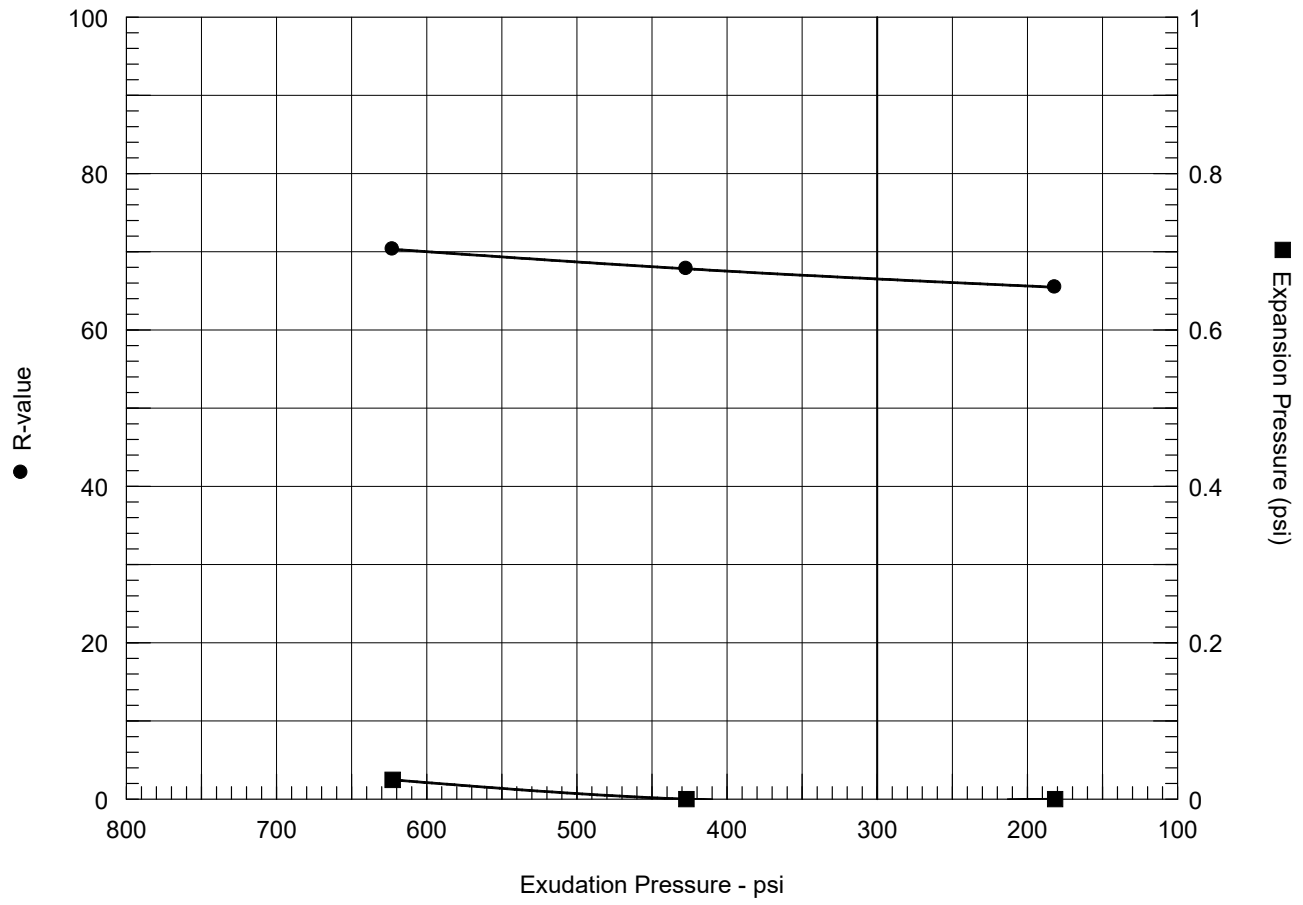
Proj. No.: 19596 **Date Sampled:** 03/26/24

DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: SC **Checked By:** AL

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	116.0	10.2	0.02	27	2.48	623	70	70
2	350	110.3	11.2	0.00	30	2.55	427	68	68
3	350	116.3	12.2	0.00	31	2.45	182	65	65

Test Results	Material Description
R-value at 300 psi exudation pressure = 67 **Exp. pressure at 300 psi exudation pressure =** 0.00 psi	POORLY GRADED SAND with silt (R-1 @ 0-5')

Project No.: 19596
Project: University Center & Student Union Buildings
Location: R-1
Sample Number: 94019 **Depth:** 0-5'
Date: 5/8/2024

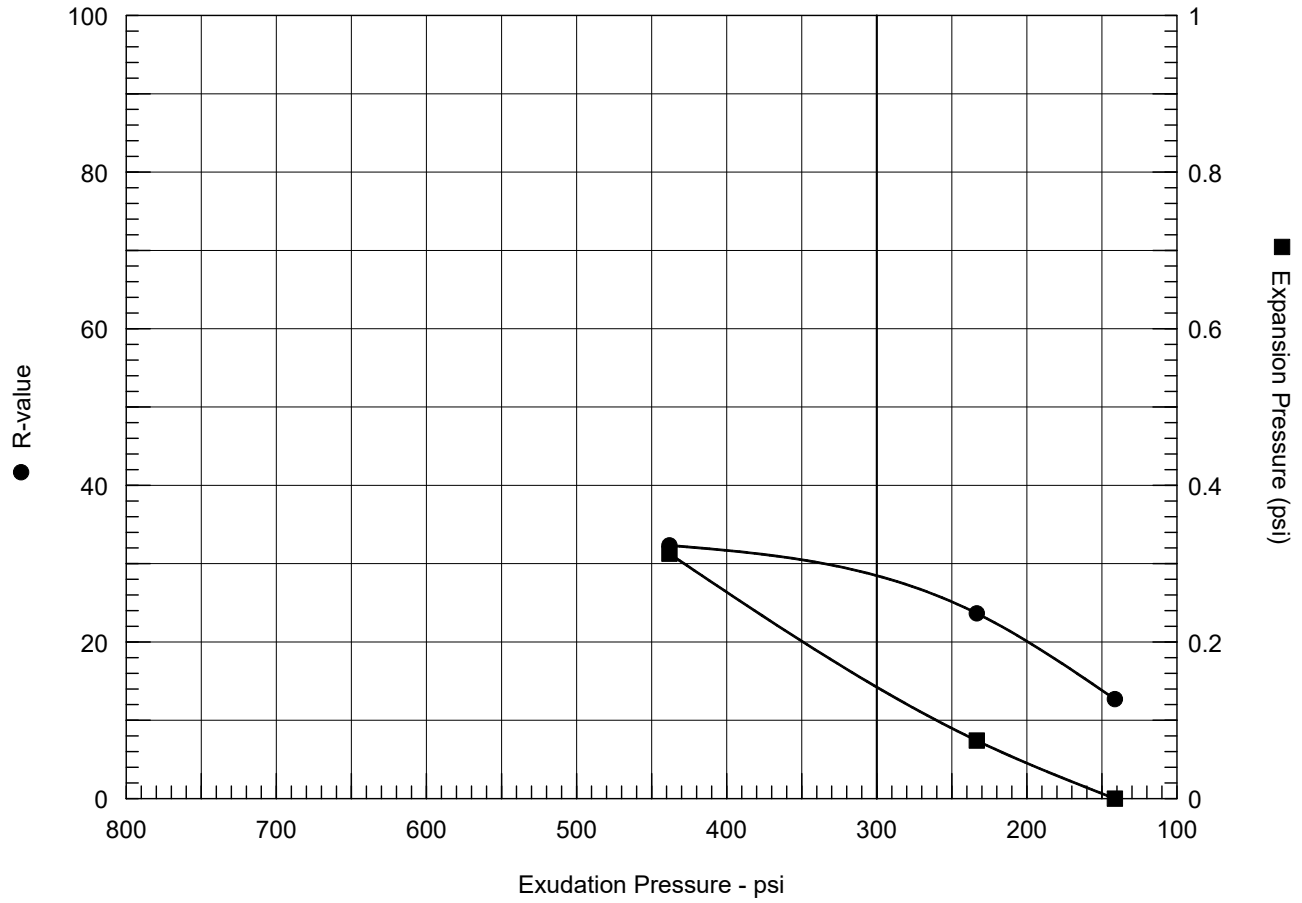
Tested by: RC
Checked by: AL
Remarks:
Test Date: 04/12/24

R-VALUE TEST REPORT

SOILS ENGINEERING, INC.

Figure D-1

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	129.5	11.7	0.31	80	2.35	438	36	32
2	125	126.2	12.8	0.07	100	2.41	233	25	24
3	60	120.1	13.9	0.00	122	2.52	141	13	13

Test Results	Material Description
R-value at 300 psi exudation pressure = 28 **Exp. pressure at 300 psi exudation pressure =** 0.14 psi	CLAYEY SAND (R-2 @ 0-5')

Project No.: 19596
Project: University Center & Student Union Buildings
Location: R-2
Sample Number: 94020 **Depth:** 0-5'
Date: 5/8/2024

Tested by: RC
Checked by: AL
Remarks:
Test Date: 05/06/24

R-VALUE TEST REPORT

SOILS ENGINEERING, INC.

Figure D-2

APPENDIX D

GEOLOGIC HAZARD STUDY

SEISMIC DESIGN INFORMATION

USGS Design Map Summary and Detail Report

EQFAULT

Version 3.00

California Fault Map

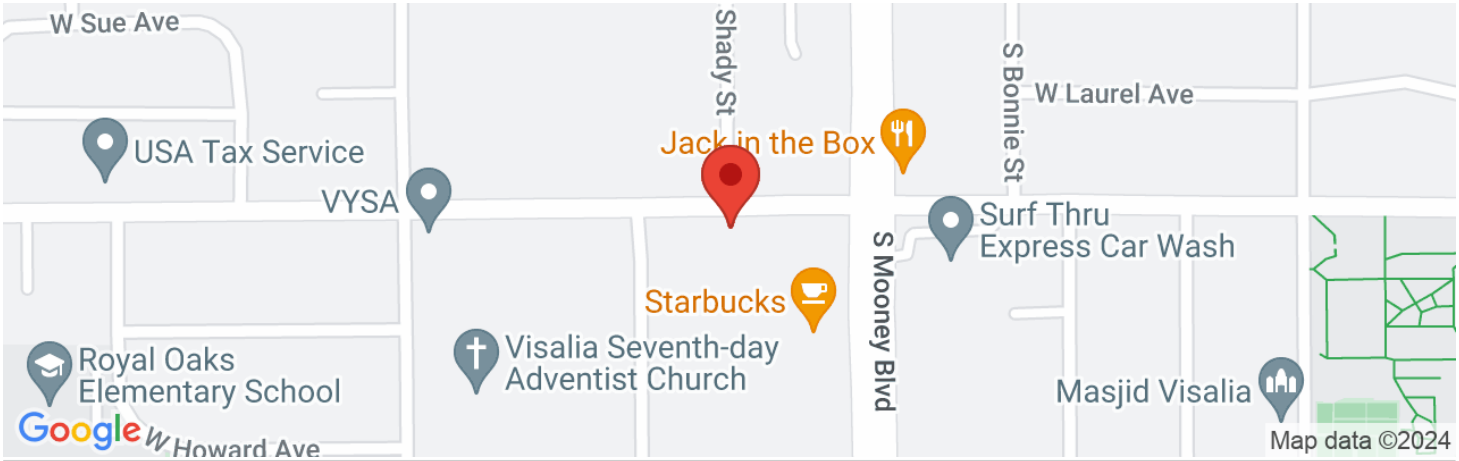
and Other Geologic Plates

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USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
USGS web services are now operational so this tool should work as expected.

19596 COS

Latitude, Longitude: 36.32004, -119.315290



Date	4/1/2024, 4:45:25 PM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.553	MCE_R ground motion. (for 0.2 second period)
S_1	0.219	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.751	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.5	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.358	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.24	MCE_G peak ground acceleration
F_{PGA}	1.36	Site amplification factor at PGA
PGA_M	0.327	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.553	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.596	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.219	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.233	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.24	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.928	Mapped value of the risk coefficient at short periods
C_{R1}	0.94	Mapped value of the risk coefficient at a period of 1 s

Type	Value	Description
C_V	1.069	Vertical coefficient

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*                    *
*    E Q F A U L T   *
*                    *
*    Version 3.00    *
*                    *
**********************
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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 19596

DATE: 04-19-2024

JOB NAME: University Center & Student Union Buildings

CALCULATION NAME: Test Run Analysis

FAULT-DATA-FILE NAME: CGSFLTE.DAT

SITE COORDINATES:
SITE LATITUDE: 36.3200
SITE LONGITUDE: 119.3153

SEARCH RADIUS: 100 mi

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
DISTANCE MEASURE: cd_2drp
SCOND: 0
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: CGSFLTE.DAT

MINIMUM DEPTH VALUE (km): 0.0

EQFAULT SUMMARY

DETERMINISTIC SITE PARAMETERS

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	ESTIMATED MAX. EARTHQUAKE EVENT: PEAK SITE ACCEL. g	ESTIMATED MAX. EARTHQUAKE EVENT: EST. SITE INTENSITY MOD.MERC.
Kern Front	32.9(53.0)	6.3	0.089	VII
GREAT VALLEY 14	42.1(67.7)	6.4	0.078	VII
GREAT VALLEY 13	48.3(77.8)	6.5	0.074	VII
GREAT VALLEY 12	57.5(92.6)	6.3	0.058	VI
GREAT VALLEY 11	64.2(103.3)	6.4	0.056	VI
INDEPENDENCE	64.4(103.6)	7.1	0.081	VII
SAN ANDREAS - 1857 Rupture M-2a	67.4(108.4)	7.8	0.093	VII
SAN ANDREAS - Cholame M-1c-1	67.4(108.4)	7.3	0.072	VI
SAN ANDREAS - Cho-Moj M-1b-1	67.4(108.4)	7.8	0.093	VII
SAN ANDREAS - Whole M-1a	67.4(108.4)	8.0	0.104	VII
SAN ANDREAS - Parkfield	67.4(108.5)	6.5	0.047	VI
SAN JUAN	70.2(113.0)	7.1	0.062	VI
BIRCH CREEK	70.9(114.1)	6.4	0.052	VI
OWENS VALLEY	72.1(116.0)	7.6	0.080	VII
SAN ANDREAS (Creeping)	72.7(117.0)	6.2	0.038	V
So. SIERRA NEVADA	74.5(119.9)	7.3	0.081	VII
ROUND VALLEY	75.2(121.0)	7.0	0.068	VI
SAN ANDREAS - Carrizo M-1c-2	75.9(122.2)	7.4	0.069	VI
GREAT VALLEY 10	77.0(124.0)	6.4	0.049	VI
FOOTHILLS FAULT SYSTEM 1	77.6(124.9)	6.5	0.051	VI
FOOTHILLS FAULT SYSTEM 2	78.6(126.5)	6.5	0.051	VI
WHITE WOLF	79.2(127.4)	7.3	0.077	VII
FOOTHILLS FAULT SYSTEM 3	80.0(128.7)	6.5	0.050	VI
WHITE MOUNTAINS	80.3(129.2)	7.4	0.066	VI
LITTLE LAKE	84.7(136.3)	6.9	0.049	VI
HILTON CREEK	85.4(137.4)	6.7	0.053	VI
HUNTER MTN. - SALINE VALLEY	85.6(137.7)	7.2	0.056	VI
FISH SLOUGH	85.7(137.9)	6.6	0.050	VI
GREAT VALLEY 9	86.6(139.4)	6.6	0.050	VI
RINCONADA	91.5(147.2)	7.5	0.063	VI
PLEITO THRUST	91.9(147.9)	7.0	0.058	VI
ORTIGALITA	92.5(148.8)	7.1	0.050	VI
HARTLEY SPRINGS	92.9(149.5)	6.6	0.047	VI
DEEP SPRINGS	93.6(150.7)	6.6	0.047	VI

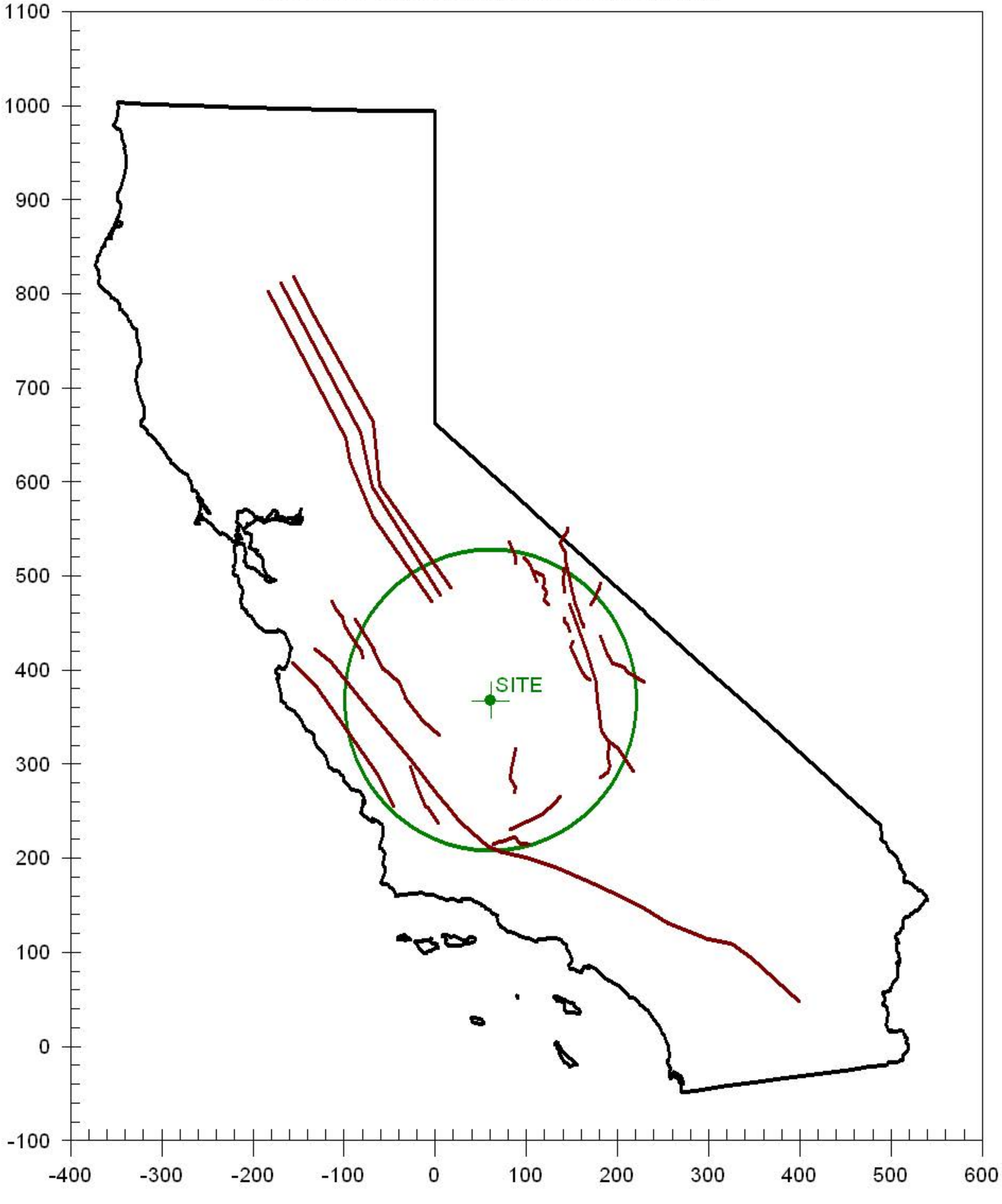
-END OF SEARCH- 34 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE Kern Front FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 32.9 MILES (53.0 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.1036 g

CALIFORNIA FAULT MAP

University Center & Student Union Buildings



GEOLOGICAL HAZARD STUDY

For

University Center & Student Union Buildings

615 S. Mooney Blvd.

in

Visalia, California

Prepared For:

College of the Sequoias
915 South Mooney Blvd.
Visalia, CA 93277

Attention:
Mr. Byron Woods

File No. 19596

Prepared By:

Soils Engineering, Inc.
4400 Yeager Way
Bakersfield, CA. 93313

May 2024

Soils Engineering Inc.

May 8, 2024 File No. 19596

College of the Sequoias
915 South Mooney Blvd
Visalia, CA 93277

Attention: Mr. Byron Woods, Dean of Facilities

Subject: Geological Hazard Study
Project: University Center & Student Union Buildings
Location: 915 S. Mooney Blvd, Visalia, CA 93277

In accordance with your request and authorization, Soils Engineering, Inc. (SEI) has performed a Geological Hazards Study for the above described subject property in Visalia, California (site). This study was conducted in compliance with the California Code of Regulations, Title 24, Chapters 16, 18 and 33 of the 2022 California Building Code and per the California Education Code.

Our Geological Hazards Assessment indicates that there is a low probability for liquefaction to occur during a major earthquake at the site if groundwater is as shallow as 36' bgs. The maximum peak ground acceleration at the site would be 0.1036g from a 8.0 magnitude earthquake on the San Andreas – Whole M-1a Fault approximately 108.4 kilometers away. The computer-modeling program Eqsearchwin estimated that a ground motion of 0.109g occurred at the site from a 7.9 magnitude earthquake (aftershock) on the San Andreas Fault on January 1, 1857. The proposed structures should be built to withstand this magnitude of an earthquake and ground motions.

The site-specific design acceleration values to be utilized for the proposed improvements should be 0.5g for short periods (S_{Ds}) and 0.473g for the 1 second period (S_{D1}). The seismic design category is a D for both short and 1-second periods per the 2022 CBC.

In the event of a major earthquake, there is a very low potential for rock falls or landslides to impact the site.

The estimated amount of total dynamic settlement that would occur at this site during a major earthquake is approximately 0.11" (B-3) to 0.16" (B-11). The estimated amount of differential settlement is 0.05" between these two borings. The settlement values appear to be acceptable for the proposed development.

There are no high-pressure natural gas or petroleum pipelines within 1500' of the site. No oil wells were ever drilled near the site and no subsurface oilfield related gases (hydrogen sulfide, methane etc.) are present beneath the site.

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Phone: 661-831-5100
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No additional geological assessment is recommended.

The accompanying report is an instrument of service of ***Soils Engineering, Inc.***. The report summarizes our findings and relates our opinions with respect to the potential for geological hazards to affect the site. Note that our findings and opinions are based on information that we obtained on given dates, through records review, site review, and related activities. It is possible that other information exists or subsequently has become known, just as it is possible for conditions we observed to have changed after our observation.

Soils Engineering, Inc. will be pleased to provide more information in this regard. Please call us for assistance at (661) 831-5100.

Sincerely,
SOILS ENGINEERING, INC.



Robert J. Becker, P.G., C.E.G.
Geologic Division Manager



On Man Lau
Engineering Manager

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Plate 1 - Site Location
Plate 2 - Plot Plan
Plate 2A- Geologic Map & Boring Locations
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Plate 3 - Visalia General Plan & Specific Plan – Regional Faults
Plate 3A- Earthquake Epicenter Map
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Plate 5 - California Fault Map
Plate 5A- Regional Faults From 2010 Fault Activity Map of California
Plate 6- CalGEM Oil Well Map
Plate 7- Regional Land Subsidence Map

Attachment A: Deterministic Site Parameters - EQFAULTWIN data, EQSEARCHWIN data, Seismic Design Report SEAOC/OSHPD. USGS Earthquake Hazard Toolbox results.

Attachment B - Boring Logs, the Flood Inundation Map for Lake Isabella, the Flood Insurance Rate Map, Historical Depth to Water Map, Pipeline Map, LiquefyPro plot and calculation sheets for liquefaction and settlement and Lab Result Table, National Pipeline Map

GEOLOGICAL HAZARD STUDY
For
College of the Sequoias

University Center & Student Union Buildings
915 S. Mooney Blvd.
in

Visalia, California
May 2024

1.0 Introduction

Soils Engineering, Inc. (SEI) has conducted a Geological Hazards Study for Raffaello Palla Elementary School Modular Buildings, located at 915 S. Mooney Blvd. (site) in Visalia, California (see Location Map, Plate 1). The site location coordinates are approximately 36.321749° north, latitude, and -119.315186° west, longitude. The following is an Executive Summary of the investigation conducted between March to May 2024.

A site reconnaissance, which consisted of walking the property and evaluating the surrounding geological features, was conducted by SEI personnel in March 2024. The Student Union Building will reside on the southern portion of the College of the Sequoias School Campus just north of W Meadow Ave. and east of the Education Support Services Building. The University Center Building will reside on the southernmost portion of the site just northeast of S Shady St. and W Tulare Ave. Currently the Student Union Building area of interest is comprised of a single store existing structure with concrete and asphaltic surface around the area. The University Center Building area of interest currently consists of an existing Palm Apartments Complex and a portion of the a strip mall surrounded by concrete and asphaltic surfaces. Adjacent improvements to the area of interests include and are not limited to existing parking areas with some solar canopies, Live Oak, a strip mall, and the College of the Sequoias campus. Campus borders include W Noble Ave/CA-198 to the north, S Mooney Blvd/commercial properties to the east, W Tulare Ave/commercial properties to the south, paved parking areas to the southwest, and S Woodland St./parking/residential properties to the west.

2.0 Geology and Hydrology

2.1 Geologic Setting

The site has a generally flat relief with a slight slope to the south. The project site rests on Quaternary Fan deposits (Qf) within the southern portion of the San Joaquin Valley. See the attached Geologic Map (Plate 2A), as interpreted from on-site soil borings and the Fresno Sheet of the Geologic Map of California (Smith, Department of Conservation Division of Mines and Geology (CDMG), 1964) and the 2010 Geologic Map of California (CDMG).

Active faults within 50 miles include the Kern Front Fault, approximately 53.0 kilometers to the south-southeast, Great Valley 14 Fault, approximately 67.7 kilometers away; and Great Valley 13 Fault, approximately 77.8 kilometers away. The site is not located within an Alquist-Priolo Special Study Zone (Earthquake Fault Zone), and the Regional faults are shown on the City of Visalia General Plan and Specific Plans, Safety and Noise, Regional Fault Map (Plate 3). Nearby active faults are shown on the 2010 Fault Activity Map of California (CDMG, 2010) within the general area of the site (Plate 5A) and on the EQFault California Fault Map (Plate 5).

Near surface soils within the zone of influence of future developments consist of interbedded silty sand, sandy silt, and sand layers overlying bedrock, which is located several thousand feet below the surface. These sediments were derived from the Sierra Nevada Mountains to the east of the site and deposited by local drainages.

2.2 Surface Lithology

Earth materials identified in eleven (11) onsite soil borings (B-1 to B-11) conducted in March 2024, consisted generally of intervals of Silty Sand (SM), Sandy Clay (CL), Poorly Graded Sand (SP), and Sandy Silt (ML) in the top 51 feet below ground surface (bgs). These soils are classified as SM, SP, ML, and CL respectively, in the Unified Soils Classification System. See attached boring logs included in Appendix B for more detail along with Plate 2B showing a cross-section A to A' between the four (4) soil borings.

2.3 Hydrology

Unconfined Aquifer - The depth to the unconfined aquifer as shown on maps prepared by the Department of Water Resources (DWR) and presented on the SGMA Data Viewer and dated Spring 2023 is approximately 161' below the ground surface. Historical depth to water data by the DWR and presented on the Water Data Library Station Map indicates high depth to water readings on nearby wells within 1-mile of the subject property ranged from 36.2' (1957) to 79.2' (2017) bgs. See Plate 4 for a depth to water map and Appendix B for a Historical Depth to Water Map.

Perched Water, Ground Water or Seepage – No shallow ground water on the site is based on the Water Data Library Station Map. No groundwater was encountered in any of the soil borings to the total depth explored of 51.5'. See Appendix B for boring logs and a Historical Depth to Water Map.

3.0 Seismic and Fault Hazards

3.1 Seismic History

There have been a number of historic earthquakes that may have affected the Bakersfield area. The following is a short summary of the major known events:

- 1/9/1857 - Fort Tejon Earthquake - San Andreas Fault, Estimated Magnitude 8.2+, 30 feet of slippage over a 200 mile area, widespread damage.

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- 7/21/1952 - Arvin/Tehachapi - White Wolf Fault, Magnitude 7.7, extensive damage to buildings and highways.

- 8/22/1952 - Bakersfield Quake (Aftershock of Arvin/Tehachapi) – 9.3 miles ESE of Bakersfield, Magnitude 5.8. Closest aftershock to Bakersfield causing extensive damage to already weakened buildings. Multiple surface fissures were created from the 1952 earthquakes.

SEI utilized the software program EQSEARCHWIN version 3.0 (Thomas F. Blake) to evaluate historical earthquakes in the area of the site over the last 200 years. The Earthquake Epicenter Map (Plate 3A) shows earthquake magnitudes and the epicentral distance from the site. The majority of the seismic activity in the area of the site has been along the San Andreas Fault and the Great Valley Faults. The closest earthquake of at least 5.0 magnitude to the site was 16.7 kilometers away, at a magnitude of 5.0 on July 25, 1868. The largest magnitude earthquake within 100 miles was 7.9 on the San Andreas Fault in 1857. The largest estimated site acceleration is 0.109 g from a 7.9 magnitude earthquake on the Sand Andreas Fault on January 9, 1857. The EQSEARCHWIN estimation of Peak Acceleration from California Earthquake Catalogs Table, Earthquake Recurrence Curve, Earthquake Epicenter Map and a graph of the Number of Earthquakes (N) above Magnitude (M) are presented in Appendix A.

3.2 Seismic Evaluation

The site is located within the Visalia Quadrangle in the southeast 1/4 of the northeast 1/4 of Section 36, Township 18 South, Range 24 East and is not located in an Alquist-Priolo special studies zone (California Fault Zone). Regional faults are shown on the City of Visalia General Plan and Specific Plans, Safety and Noise, Regional Fault Map (Plate 3).

The nearest active fault, as indicated by the computer-modeling program EQFault version 3.0, is the Kern Front Fault approximately 53.0 kilometers to the south-southeast. The Great Valley 14 Fault is approximately 67.7 kilometers away: the Great Valley 13 Fault, approximately 77.8 kilometers away. Regional faults in relation to the site location are presented on Plate 5A and are from the 2010 Fault Activity Map of California (CDMG, 2010).

3.3 Seismic Design

The seismic design values presented in the table below are based on the 2022 CBC. The Site Class for the proposed project is a Site Class "D" in accordance with the 2022 CBC §1613.2.2, soil boring data and local knowledge. The site is not located within an Alquist-Priolo (earthquake fault) Special Study Zone.

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SEISMIC DESIGN CRITERIA		VALUE	SOURCE
Risk Category		**III**	2022 CBC Table 1604.5 or 1604*A*.5
Site Class		**D**	2022 CBC § 1613.2.2 or 1613*A*.2.2; ASCE 7-16 Table. 20.3-1; Site Specific Soils Report
Mapped MCE_R Spectral Response Acceleration, short period	**S_S**	**0.553g**	SEAOC-OSHPD software; 2022 CBC Figure 1613.2.1(1)
Mapped MCE_R Spectral Response Acceleration, at 1-sec. Period	**S_1**	**0.219g**	SEAOC-OSHPD software; 2022 CBC Figure 1613.2.1(2)
Site Coefficient	**F_a**	**1.358**	SEAOC- OSHPD software; 2022 CBC Table 1613.2.3(1) or 1613*A*.2.3(1)
Site Coefficient	**F_v***	**2.162***	2022 CBC Table 1613.2.3(2) or 1613*A*.2.3(2)
Adjusted MCE_R Spectral Response Acceleration, short period, $F_a * S_s$	**S_{MS}**	**0.751g**	SEAOC- OSHPD software; 2022 CBC § 1613.2.3 or 1613*A*.2.3
Adjusted MCE_R Spectral Response Acceleration, 1-sec. period, $F_v * S_{1*} * 1.5$	**S_{M1}***	**0.710g***	2022 CBC § 1613.2.3 or 1613*A*.2.3, ASCE 7-16, Supplement 3, § 11.4.8
Design Spectral Response Acceleration, short period, 2/3 * S_{MS}	**S_{DS}**	**0.5g**	SEAOC- OSHPD software; 2022 CBC § 1613.2.4 or 1613*A*.2.4
Design Spectral Response Acceleration, 1-sec. period, 2/3 * S_{MI}	**S_{D1}***	**0.473g***	2022 CBC § 1613.2.4 or 1613*A*.2.4
Peak Ground Acceleration for Max. Considered Earthquake (MCE_G)	**PGA**	**0.24g**	SEAOC- OSHPD software; ASCE 7-16 Fig 22-9
Site Coefficient, F_{PGA} = 1.36, F_{PGA}* PGA	**PGA_M**	**0.327g**	SEAOC- OSHPD software; ASCE 7-16 § 11.8.3.2
Seismic Design Category, short period		**D**	2022 CBC § 1613.2.5
Seismic Design Category, 1second period *		**D***	2022 CBC § 1613.2.5
**See requirements for site-specific ground motions in Section 11.4.8. The values tabulated above for S_{M1}, S_{D1}, and the Seismic Design Category/1-second period are based on the site coefficient, F_v, interpolated from 2022 CBC Table 1613.2.3(2) or 1613A.2.3(2) and Supplement 3, § 11.4.8.*			
MCE_R = Maximum Considered Earthquake (risk targeted) MCE_G = Maximum Considered Earthquake (geometric mean)			

See attached SEAOC/OSHPD seismic design data in Appendix A.

3.4 Seismology & Calculation of Earthquake Ground Motion

The site is not located within or directly adjacent to a mapped Alquist-Priolo (AP) Earthquake Zone and is not a Seismic Design Category E or F. Per Supplement 3 of Section 11.4.8 of ASCE 7-16, the value of Sm1 has been increased by 50% to be exempt from conducting a Site-Specific Ground Motion Hazard Analysis. The above seismic design information in Section 3.3 will be utilized for this project.

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3.5 Possible Earthquake Effects

A number of active faults are located within a 50-mile radius of the subject site. To evaluate the affect a major earthquake might have on the site, the computer modeling programs EQFaultwin vers. 3.0 (Thomas Blake) were utilized. Site-specific parameters were inputted, and the programs computed the maximum peak site ground accelerations resulting from an earthquake. Because ground accelerations are based largely on fault distance and magnitude, we have focused our analysis on those faults which are close to the site, or that have large maximum credible magnitudes, or a combination of the two. The result of this analysis is presented below in Table A.

This analysis estimates that a maximum peak ground acceleration of 0.1036g would be felt at the site as a result of a maximum earthquake of magnitude 8.0 on the San Andreas – Whole M-1a Fault approximately 108.4 kilometers away. See attached Deterministic Site Parameters for a full listing of computed values for faults within a 100-mile radius of the site in Appendix A. Also attached is a California Fault Map showing nearby faults in relationship to the site (Plate 5).

Utilizing the USGS Earthquake Hazard Toolbox program the Probabilistic Seismic Hazard Deaggregation for the Site was calculated to be 0.3249g for 2% chance every 50 years of exceedance. See Appendix A for this calculation results page.

TABLE A

FAULT	Approximate Distance (Km)	**Maximum Earthquake Magnitude** (Mw)	Maximum Peak Ground Acceleration	Estimated Site Intensity (MM)
Kern Front	53.0	6.3	0.089	VII
Great Valley 14	67.7	6.4	0.078	VII
Great Valley 13	77.8	6.5	0.074	VII
SAN ANDREAS - 1857 Rupture M-2a, and other segments	67.4	7.3 to 8.0	0.104	VII

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3.6 Potential For Ground Rupture, Ground Shaking, Ground Failure

Ground rupture may occur along a fault trace in a major earthquake. It is unlikely that ground rupture could occur at this site since it is not located within 500 feet of a suspected active fault. Some ground shaking is likely at this site in the event of a major earthquake on one of the nearby faults. Based on the predicted maximum horizontal accelerations at the site and the soil types identified in this investigation, ground failure is highly unlikely at this site.

3.7 Potential for Earthquake-Induced Flooding and Flood Zone

The potential for earthquake-induced flooding at the site appears to be low since groundwater has been historically over 36.2' below the ground surface. The areas of interest of where the buildings are to be built are located within flood Zone X with a 0.2% annual chance of flood hazard according to the Flood Insurance Rate Map covering the site area (see Appendix B for map).

The school also has a detailed Emergency Response Plan which includes protocols for responses to earthquakes, flooding, fire and other hazards.

3.8 Liquefaction Potential

Groundwater was not encountered in any of the borings conducted in the geotechnical soil borings conducted on-site to depths as great as 51.5' bgs. The unconfined aquifer is not shown to be less than 50 feet below ground surface at the site since the 1960's. Historical depth to water data by the DWR and presented on the Water Data Library Station Map indicates depth to water on a nearby well within 1-mile of the subject property was 36.2' bgs in 1957. SPT blowcounts in the deep SEI soil borings B-3 and B-11 ranged from 5 to 39 blowcounts per foot to a depth of 51'. The lithology encountered in the subsurface includes silty sand, sandy silt, clayey sand, sandy clay and occasional poorly graded sand zones in the borings. A liquefaction analysis was performed on the deep borings B-3 and B-11 utilizing the program LiquefyPro (version 5.9b). Site-specific information was used in this analysis including; SPT blowcounts per foot, grain-size analysis, wet weight densities, the moment magnitude earthquake and the PGA for the MCEg earthquake motion (0.327g) and a very conservative depth to water of 36'. The liquefaction potential at this site appears to be low. See attached LiquefyPro data in Appendix B and boring logs for more detail.

3.9 *Slope Stability*

The site is located in an area with <0.5 percent slopes across the site. No bedrock outcrops are present within 1/2 mile of the site. No evidence of historic landslides or creep was observed in this area. There is a very low potential for rockfalls or landslides to impact the site in the event of a major earthquake. Overall, the site appears to be stable.

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3.10 *Settlement*

The estimated amount of dynamic settlement that would occur at this site during a major earthquake is approximately 0.11" (B-3) to 0.16" (B-11) based on the lithology encountered, the SPT blowcounts recorded during sampling and the settlement analysis conducted on borings B-3 and B-11 utilizing the program LiquefyPro. The estimated amount of differential settlement is 0.05" between the two (20 borings approximately 700' apart according to the program LiquefyPro results. These settlement values appear to be acceptable for the proposed development. See attached Liquefaction Analysis Calculation Sheets and graphs in Appendix B for more detail.

3.11 Expansive Soil and Hydrocollapse Potential

Based on the lithology encountered in the top 10 feet in the soil borings it appears unlikely that highly expansive surface soils will be present at this site. An Expansion Index (EI) tests on samples B6 @ 0 to 5' and B10 @ 0 to 5'were both 0 indicating no expansion potential. Consolidation tests on samples B-2 @ 6', B7 @ 6' and B10 @ 6' were all <0.2%. See Lab Result Table in Appendix B for more detail.

The main causes of land subsidence are Tectonic Subsidence, Oil & Gas Fluid Extraction, Groundwater Withdrawal and Hydrocompaction of Moisture Deficient Alluvial Deposits. The Department of Water Resources SGMA Data Viewer Land Subsidence Map shows land subsidence within the area. The school site is located within the area where a low amount of historic land subsidence has occurred with only 0 to 5' land subsidence has occurred from 1949 to 2005 as shown on attached Plate 7. In addition, the school site is in an area where oil & gas activity is minor, no agricultural activities are present within the vicinity, and with only two public water well present nearby, so groundwater withdrawal appears to be limited. Based on this information it appears that regional subsidence should not be an issue at this site requiring any special mitigation or requirements.

4.0 High-Pressure Pipelines & Hazardous Materials

4.1 High-Pressure Pipelines

According to the National Pipeline Mapping System, there appears to be no high-pressure natural gas or petroleum pipelines within 1500' of the site.

4.2 Hazardous Materials

The site is not within an active oil or gas field. It appears no oil wells were ever drilled near the site. It is unlikely that the oilfield activities have impacted the subsurface soil or soil gas beneath the subject site with chemicals of concern (methane, H2S, etc.). See Plate 6 for the site location in reference to the nearest oil and gas wells.

5.0 Conclusions & Recommendations

Our Geological Hazards Assessment indicates that there is a low probability for liquefaction to occur during a major earthquake at the site if groundwater is as shallow as 36' bgs. The maximum peak ground acceleration at the site would be 0.1036g from a 8.0 magnitude earthquake on the San

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Andreas – Whole M-1a Fault approximately 108.4 kilometers away. The computer-modeling program Eqsearchwin estimated that a ground motion of 0.109g occurred at the site from a 7.9 magnitude earthquake (aftershock) on the San Andreas Fault on January 1, 1857. The proposed structures should be built to withstand this magnitude of an earthquake and ground motions.

The site-specific design acceleration values to be utilized for the proposed improvements should be 0.5g for short periods (S_{Ds}) and 0.473g for the 1 second period (S_{D1}). The seismic design category is a D for both short and 1-second periods per the 2022 CBC.

In the event of a major earthquake, there is a very low potential for rock falls or landslides to impact the site.

The estimated amount of total dynamic settlement that would occur at this site during a major earthquake is approximately 0.11" (B-3) to 0.16" (B-11). The estimated amount of differential settlement is 0.05" between these two borings. The settlement values appear to be acceptable for the proposed development.

There are no high-pressure natural gas or petroleum pipelines within 1500' of the site. No oil wells were ever drilled near the site and no subsurface oilfield related gases (hydrogen sulfide, methane etc.) are present beneath the site.

No additional geological assessment is recommended.

5.0 Attachments

5.1 Location Map- Plate 1, "Location Map" shows the location of the site with relationship to roads and land features.

5.2 Plot Plan - Plate 2, "PLOT PLAN" shows the location and lot configuration of the property.

5.2.1 Plate 2A, Geologic Map shows the site geology related to local topography, streets and nearby surficial features.

5.2.2 Plate 2B, Geologic Cross-Section A to A', shows the subsurface lithology encountered in some of the soil borings at the site.

5.3 Visalia General Plan & Specific Plan – Regional Fault Map - Plate 3, Shows local geology and faults near the site.

5.3.1 Earthquake Epicenter Map - Plate 3A, Shows the site location on an earthquake epicenter map of historical earthquakes with magnitudes >5.0, from the Eqsearchwin computer modeling program.

5.4 Depth To Groundwater Map - Plate 4, Shows the site location in relation to a Depth To Water Map of the regional area prepared by the Department of Water Resources.

5.5 Fault Location Map- Plate 5, Shows the site in relation to the nearest active faults within 100 miles based on the EQFault program.

5.5.1 Plate 5A shows the Regional Faults based on the Fault Activity Map of California 2010.

5.6 CalGEM Oil Well Map - Plate 6, Shows the site in relation to the nearest oil wells drilled

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near the site.

5.7 Plate 7, Regional Land Subsidence Map – Shows the site location on a Map that presents the areas of known regional subsidence in the Visalia area.

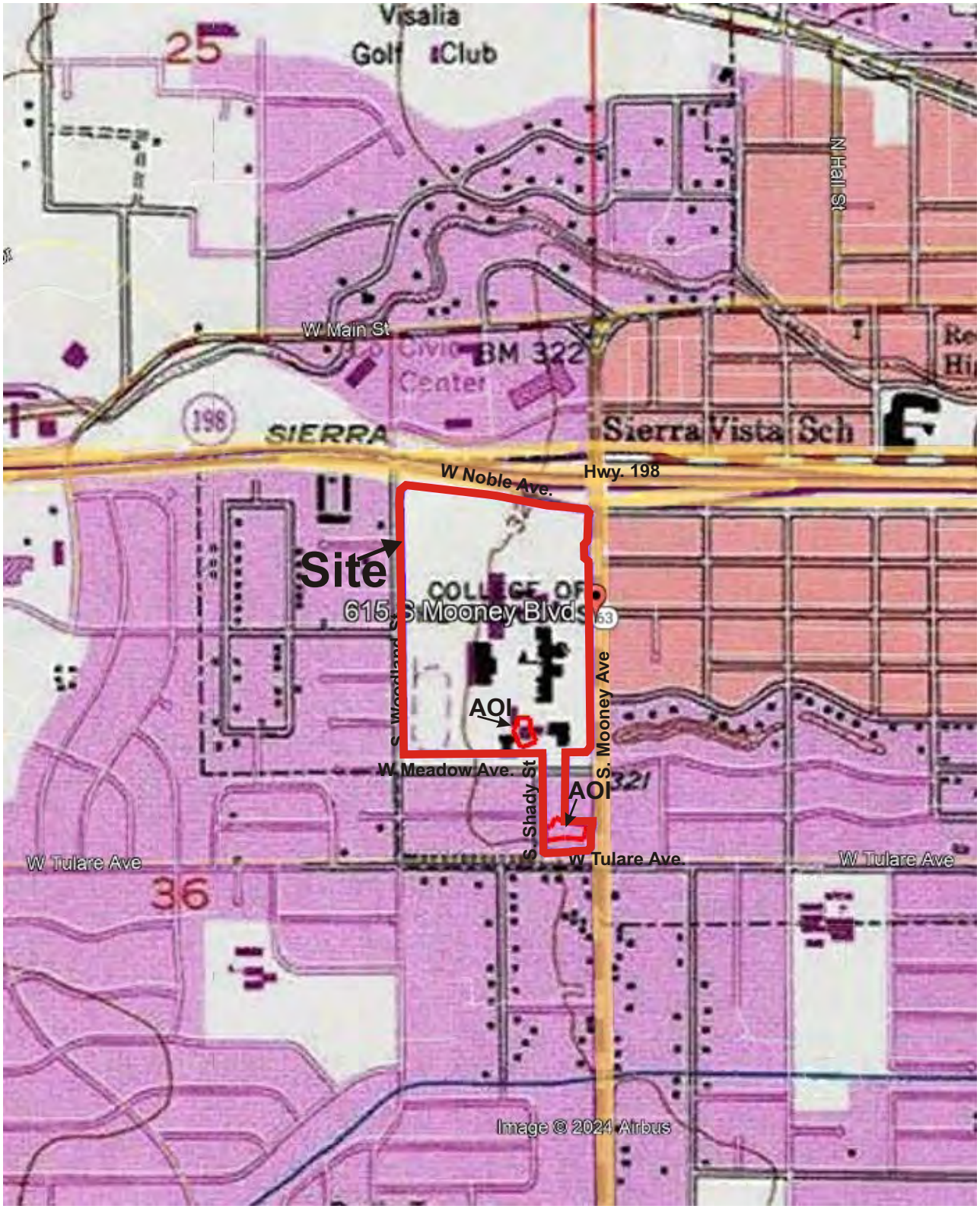
5.8 Appendix A - Deterministic Site Parameters - EQFAULTWIN data determined for the site for faults within 100 miles. EQSEARCHWIN data concerning the distance and magnitude of earthquakes within 100 miles of the site is attached. USGS Earthquake Hazard Toolbox Disaggregation plot and results are attached.

5.9 Appendix B - Presents the Boring Logs, the Flood Insurance Rate Map, Historical Depth to Water Maps, LiquefyPro plot and calculation sheet for liquefaction and settlement and Lab Result Table. National Pipeline Map.

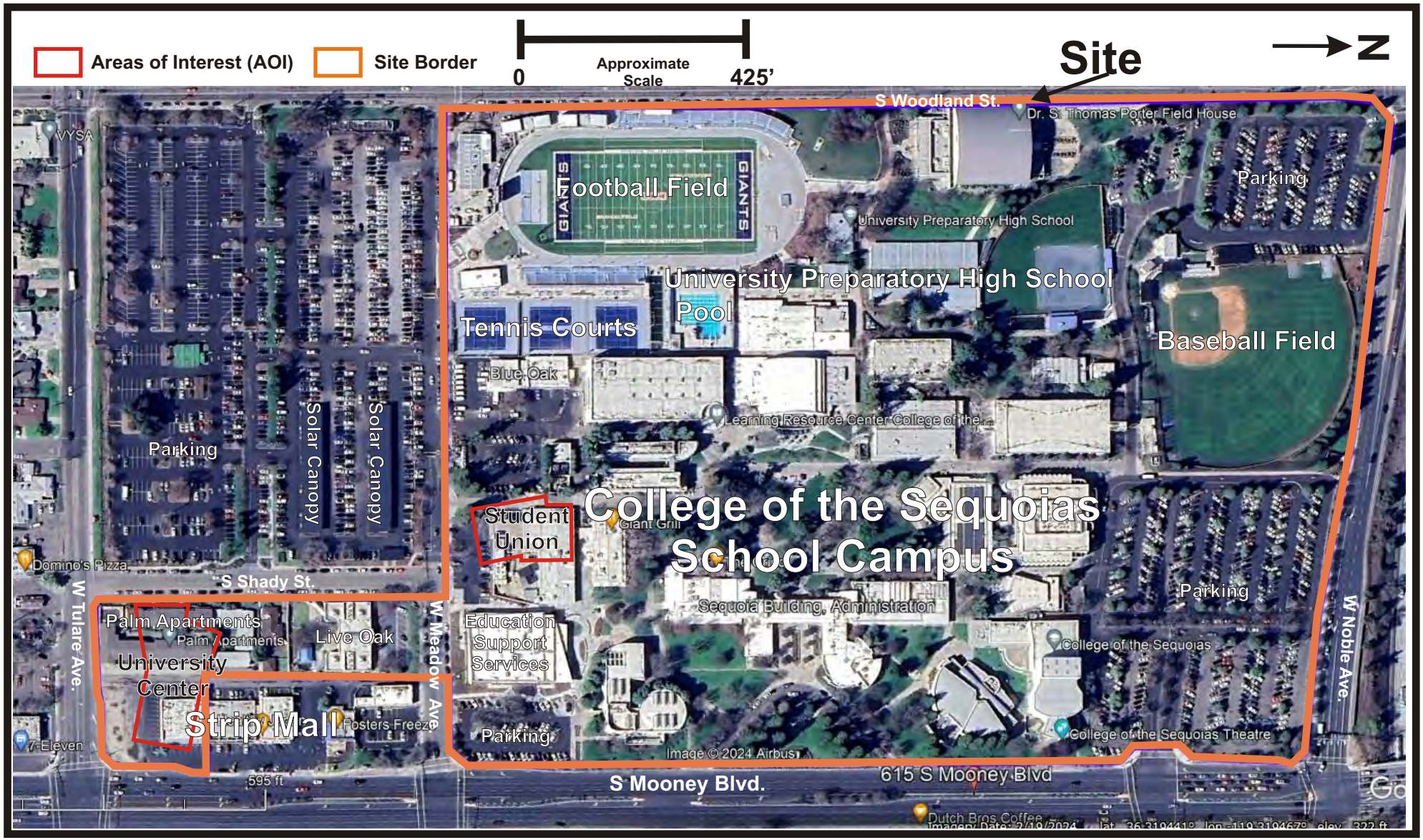
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-
- USGS Earthquake Hazard Toolbox; https://earthquake.usgs.gov/nshmp/
- National Pipeline Mapping System: Public Viewer, pvnpms.phmsa.dot.gov/PublicViewer/
- General Plan and Specific Plans, Safety and Noise, Figure 8-1: Regional Faults, Visalia, CA, October 2014: https://www.visalia.city/depts/community_development/planning/gp.asp

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SOILS ENGINEERING, INC. **4400 Yeager Way** **Bakersfield, CA 93313** **(661) 831 - 5100** DATE: 4/24 PROJECT: #19596	**College of the Sequoias** **University Center & Student Union Buildings** **915 S. Mooney Blvd** **Visalia, CA** **Location Map**	**PLATE** **1**

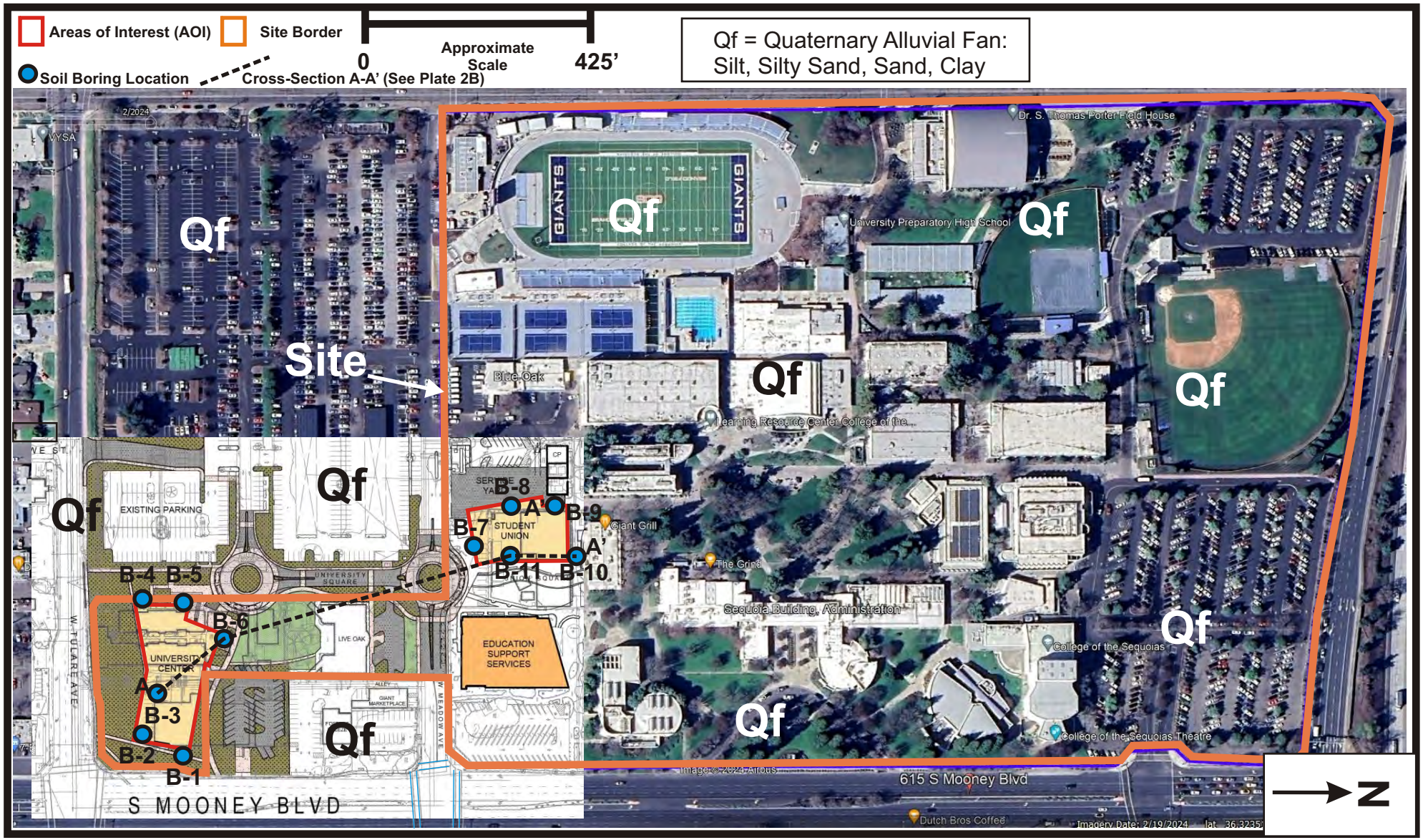


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915 S. Mooney Blvd
Visalia, CA

Plot Plan

PLATE
2

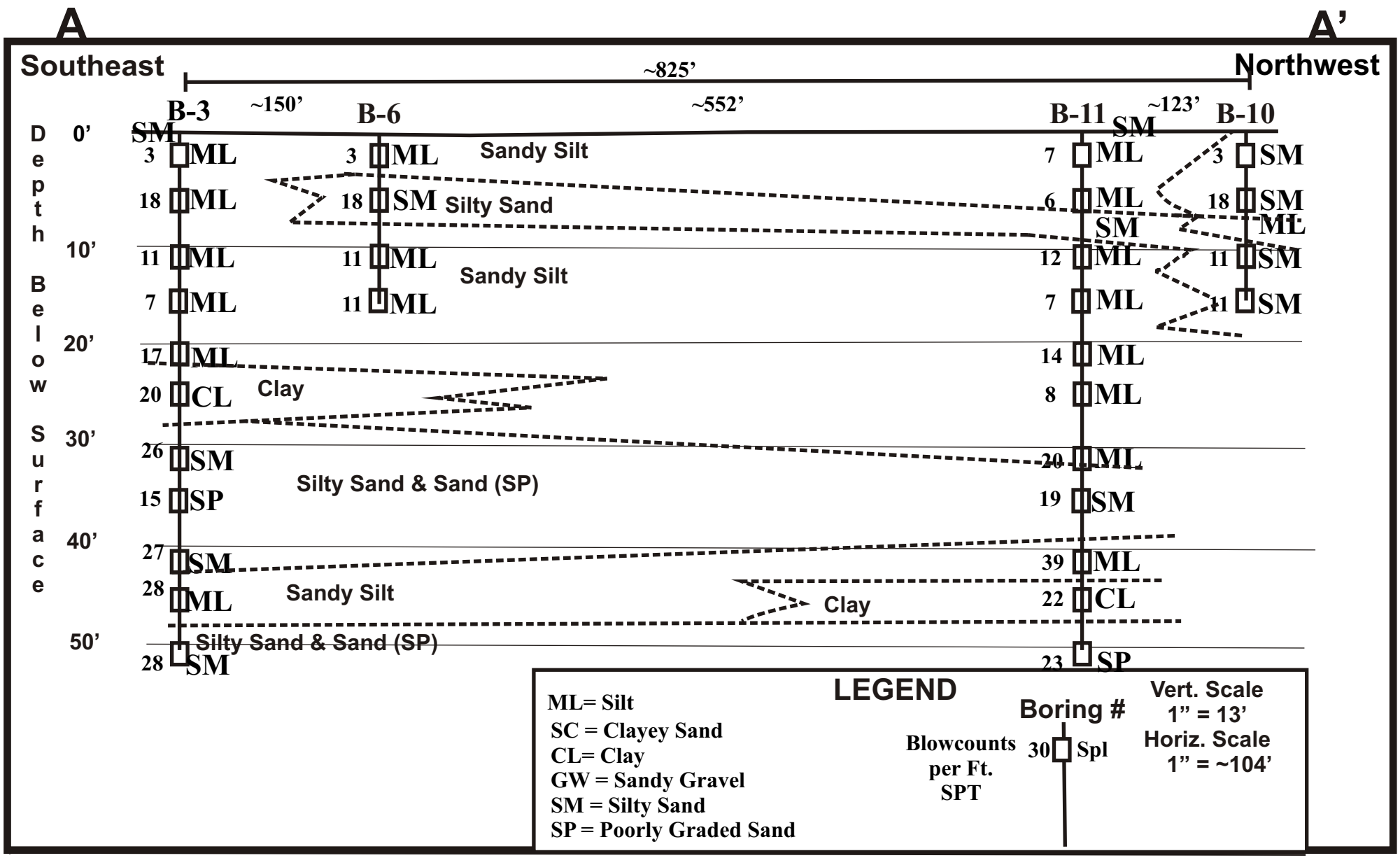


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PROJECT: #19596

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Boring Location/Geologic Map

PLATE
2



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PROJECT: #19596

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915 S. Mooney Blvd
Visalia, CA

Geologic Cross-section A to A'

PLATE
2B

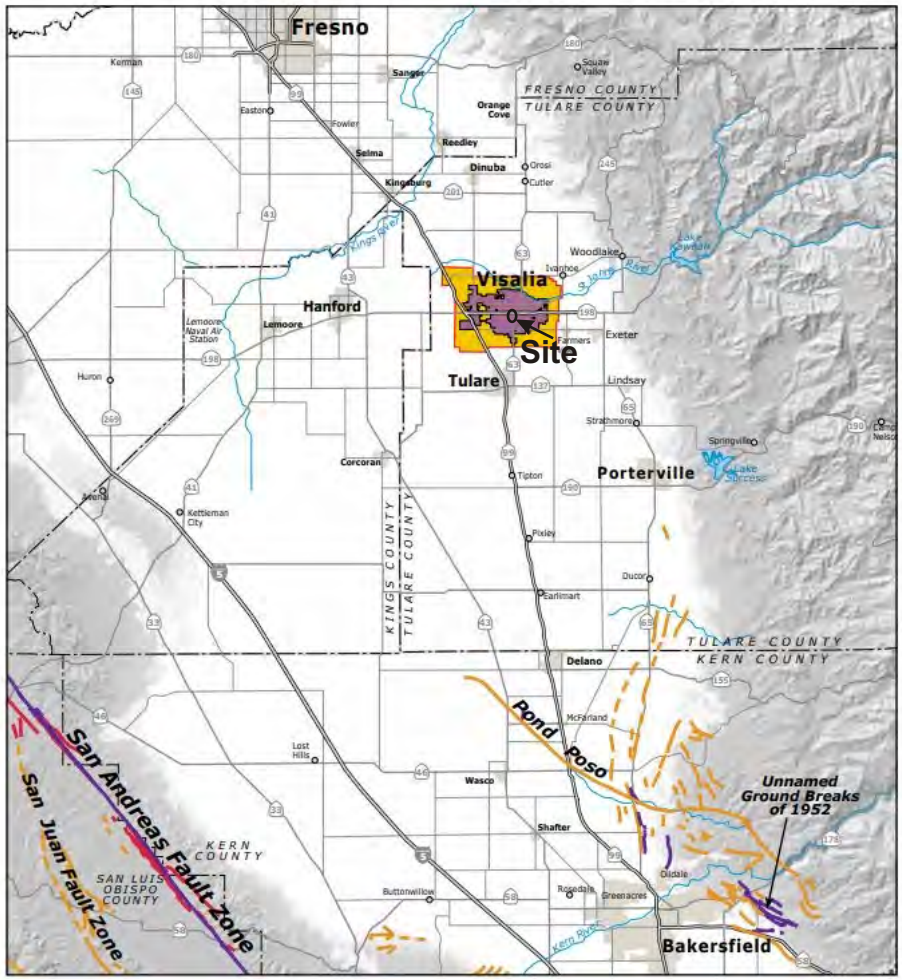


Figure 8-1: Regional Faults

N

Active Fault with Historic (last 200 years) Displacement

Active Fault with Holocene (last 11,000 years) Displacement

Potentially Active Fault with Quaternary (last 1,600,000 years) Displacement

Visalia City Limits

Planning Area

County

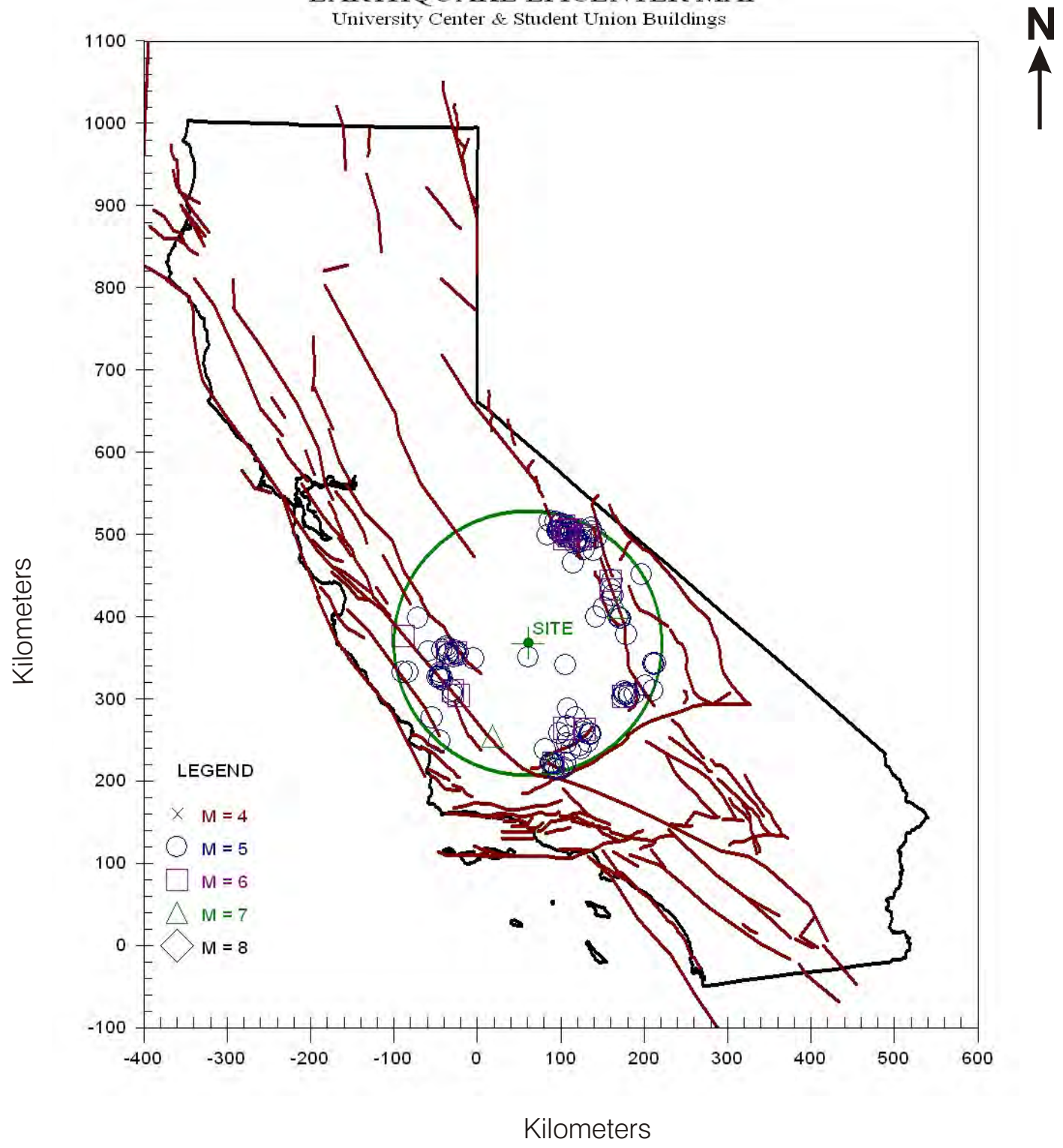
Source: Department of Conservation, California Geological Survey, 2005.

OCTOBER 2014 8-3

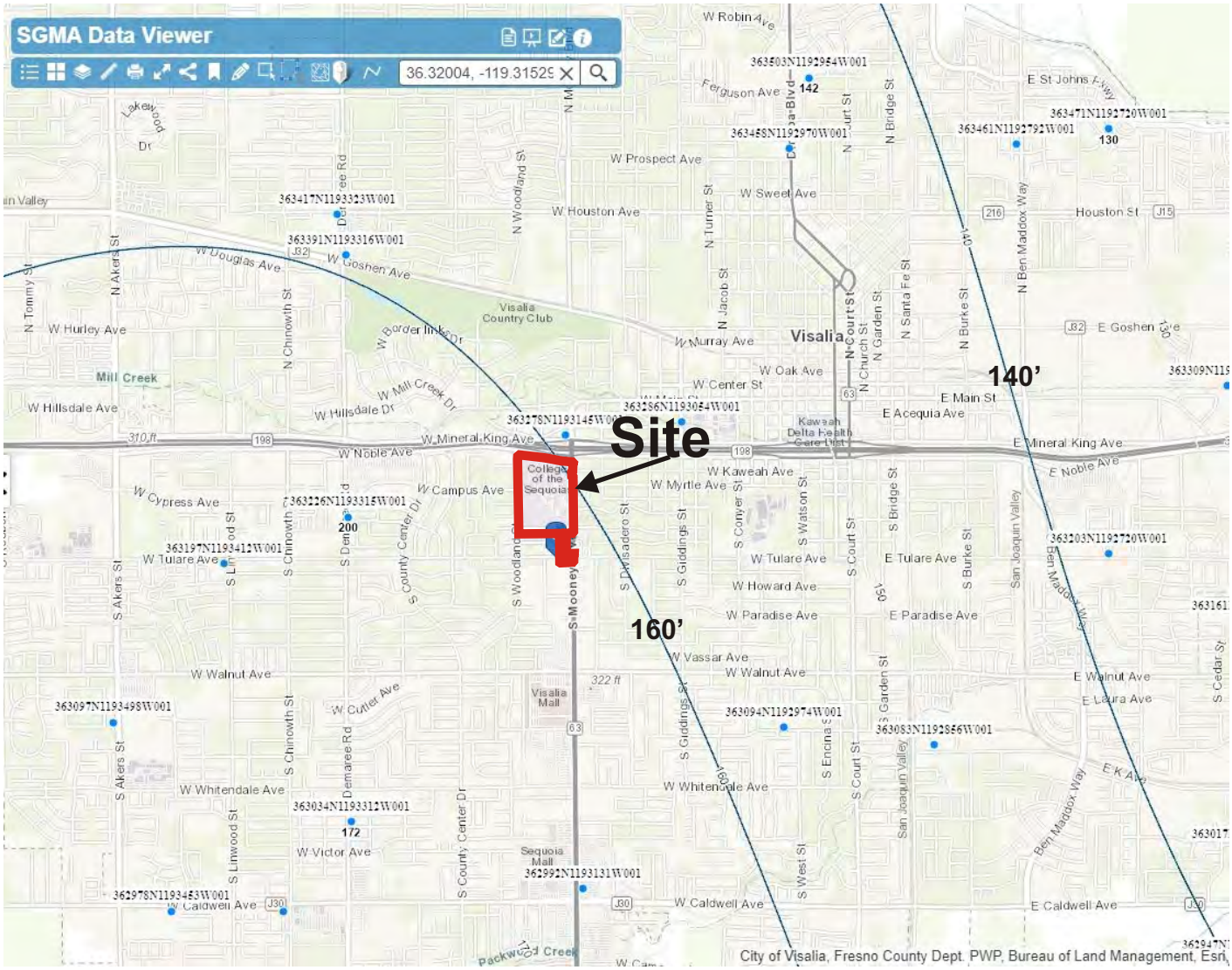
SOILS ENGINEERING, INC. **4400 Yeager Way** **Bakersfield, CA 93313** **(661) 831-5100** DATE: 4/24 PROJECT: #19596	**College of the Sequoias** **University Center & Student Union Buildings** **915 S. Mooney Blvd** **Visalia, CA** Visalia General Plan and Specific Plans Regional Faults	PLATE 3

EARTHQUAKE EPICENTER MAP

University Center & Student Union Buildings

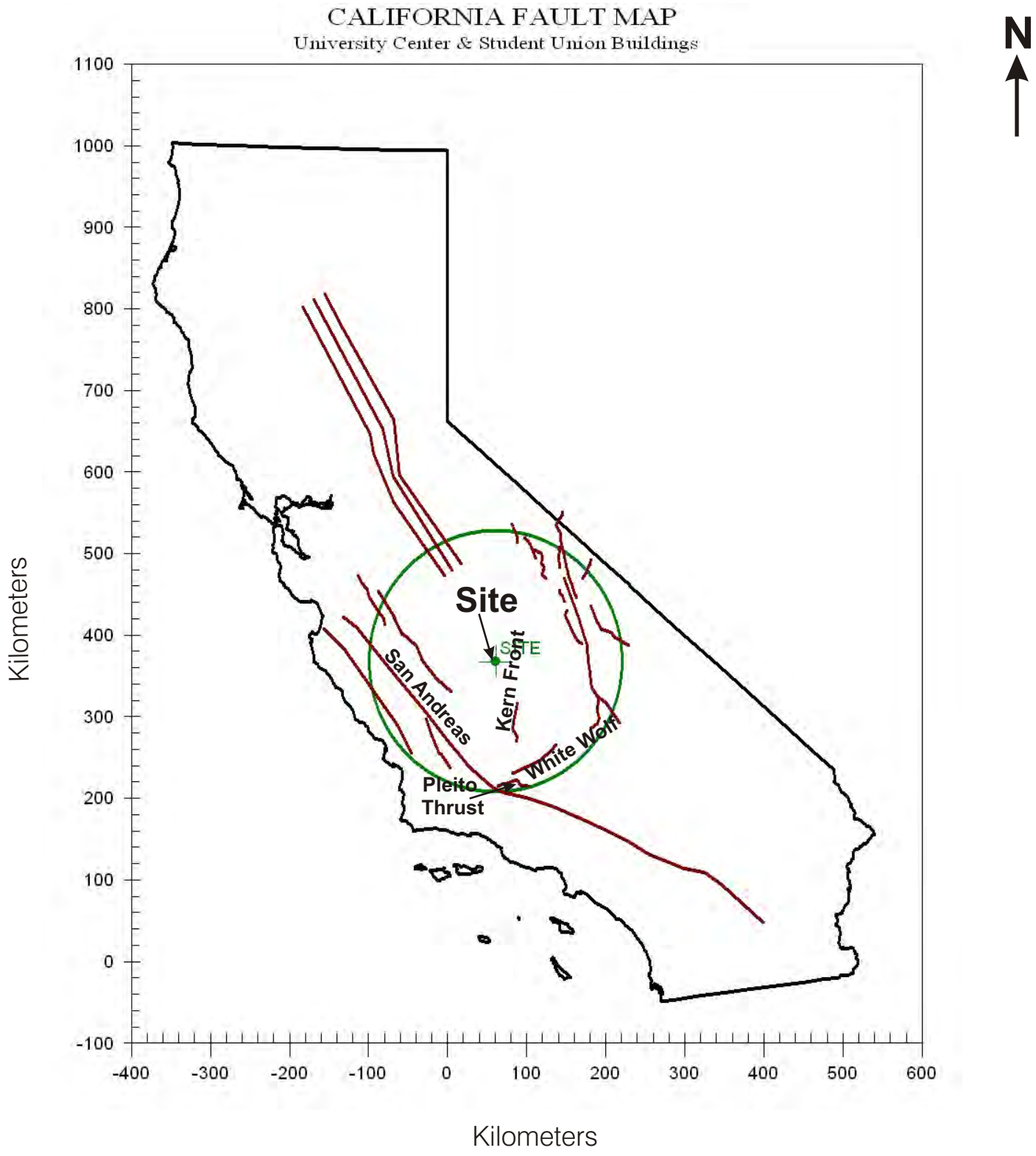


SOILS ENGINEERING, INC. **4400 Yeager Way** **Bakersfield, CA 93313** **(661) 831-5100** DATE: 4/24 PROJECT: #19596	**College of the Sequoias** **University Center & Student Union Buildings** **915 S. Mooney Blvd** **Visalia, CA** Earthquake Epicenter Map	**PLATE** 3A



DWR, SGMA Data Viewer, Depth To Water Map, Spring 2023

SOILS ENGINEERING, INC. **4400 Yeager Way** **Bakersfield, CA 93313** **(661) 831-5100** DATE: 4/24 PROJECT: #19596	**College of the Sequoias** **University Center & Student Union Buildings** **915 S. Mooney Blvd** **Visalia, CA** **Depth To Water Map**	**PLATE** **4**



SOILS ENGINEERING, INC. **4400 Yeager Way** **Bakersfield, CA 93313** **(661) 831-5100** DATE: 4/24 PROJECT: #19596	**College of the Sequoias** **University Center & Student Union Buildings** **915 S. Mooney Blvd** **Visalia, CA** Fault Location Map	**PLATE** 5

FAULT CLASSIFICATION COLOR CODE
(Indicating Recency of Movement)

Fault along which historic (last 200 years) displacement has occurred.

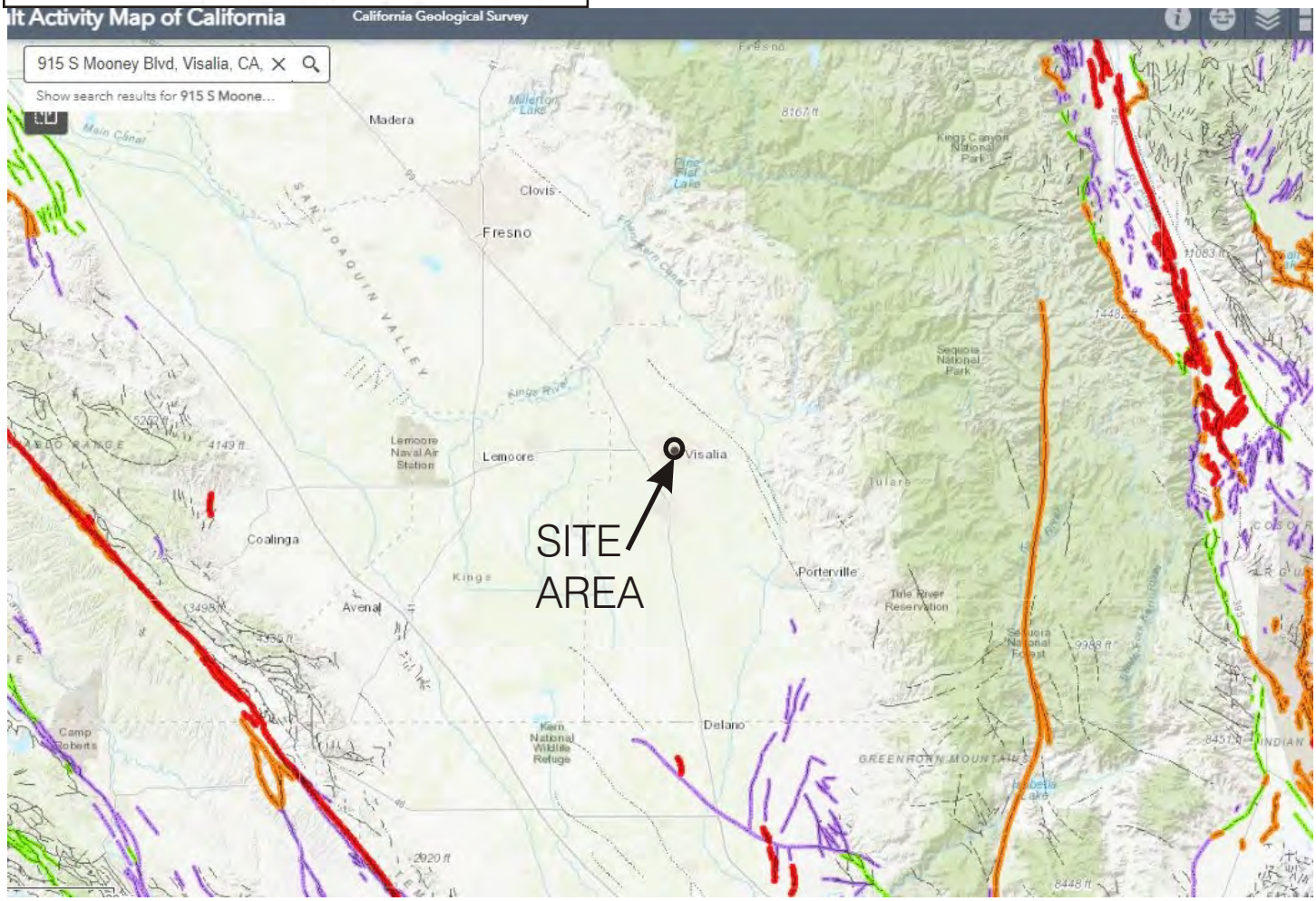
Holocene fault displacement (during past 11,700 years) without historic record.

Late Quaternary fault displacement (during past 700,000 years).

Quaternary fault (age undifferentiated).

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement.

N



SOURCE: 2010 Fault Activity Map of California, CDMG

SOILS ENGINEERING, INC. **4400 Yeager Way** **Bakersfield, CA 93313** **(661) 831-5100** DATE: 4/24 PROJECT: #19596	**College of the Sequoias** **University Center & Student Union Buildings** **915 S. Mooney Blvd** **Visalia, CA** **REGIONAL FAULT MAP**	**PLATE** **5A**

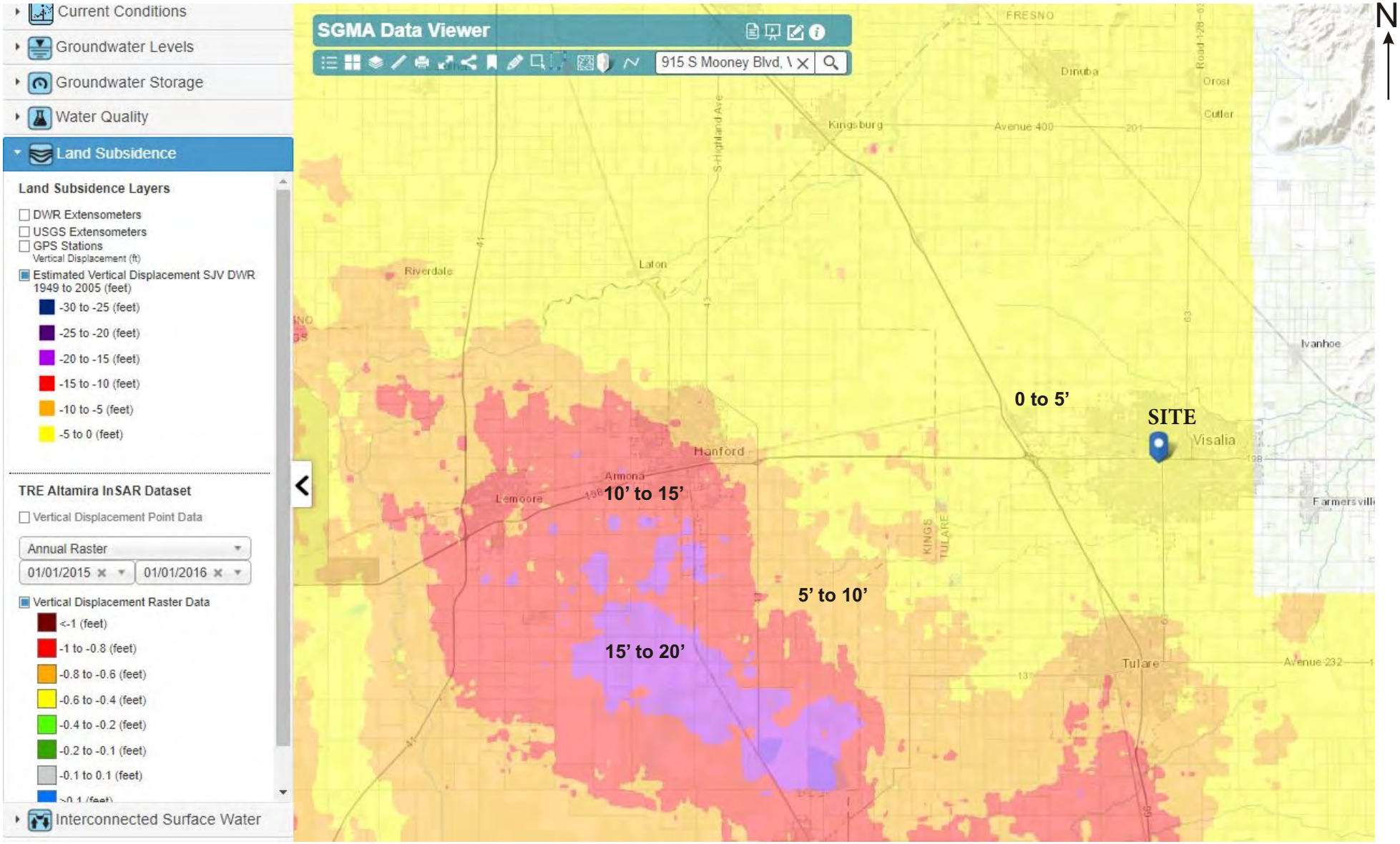
Basic Well Symbols	
Well Status or Type	**Symbol**
Active	
New	
Idle	
Plugged	
Unknown	
Canceled	
Oil, Gas	
Dry Gas	
Injector	
Cyclic Steam	
Gas Storage	
Observation	O
Water Source	W
Multi	M
Unknown	?

Plugged/Abandoned Oil Well

N



SOILS ENGINEERING, INC. **4400 Yeager Way** **Bakersfield, CA 93313** **(661) 831 - 5100** DATE: 4/24 PROJECT: #19596	**College of the Sequoias** **University Center & Student Union Buildings** **915 S. Mooney Blvd** **Visalia, CA** **CalGEM Oil Well Map**	**PLATE** **6**



DWR, SGMA Data Viewer, Land Subsidence Map, 1949 to 2005

Land Subsidence Map

Plate 7

Appendix A

EQFAULTWIN data, EQSEARCHWIN data, Seismic Design Maps SEAOC/OSHPD, and USGS Earthquake Hazard Toolbox Results.

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*    E Q F A U L T   *
*                    *
*    Version 3.00    *
*                    *
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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 19596

DATE: 04-19-2024

JOB NAME: University Center & Student Union Buildings

CALCULATION NAME: Test Run Analysis

FAULT-DATA-FILE NAME: CGSFLTE.DAT

SITE COORDINATES:
SITE LATITUDE: 36.3200
SITE LONGITUDE: 119.3153

SEARCH RADIUS: 100 mi

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
DISTANCE MEASURE: cd_2drp
SCOND: 0
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: CGSFLTE.DAT

MINIMUM DEPTH VALUE (km): 0.0

EQFAULT SUMMARY

DETERMINISTIC SITE PARAMETERS

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	ESTIMATED MAX. EARTHQUAKE EVENT: PEAK SITE ACCEL. g	ESTIMATED MAX. EARTHQUAKE EVENT: EST. SITE INTENSITY MOD.MERC.
Kern Front	32.9(53.0)	6.3	0.089	VII
GREAT VALLEY 14	42.1(67.7)	6.4	0.078	VII
GREAT VALLEY 13	48.3(77.8)	6.5	0.074	VII
GREAT VALLEY 12	57.5(92.6)	6.3	0.058	VI
GREAT VALLEY 11	64.2(103.3)	6.4	0.056	VI
INDEPENDENCE	64.4(103.6)	7.1	0.081	VII
SAN ANDREAS - 1857 Rupture M-2a	67.4(108.4)	7.8	0.093	VII
SAN ANDREAS - Cholame M-1c-1	67.4(108.4)	7.3	0.072	VI
SAN ANDREAS - Cho-Moj M-1b-1	67.4(108.4)	7.8	0.093	VII
SAN ANDREAS - Whole M-1a	67.4(108.4)	8.0	0.104	VII
SAN ANDREAS - Parkfield	67.4(108.5)	6.5	0.047	VI
SAN JUAN	70.2(113.0)	7.1	0.062	VI
BIRCH CREEK	70.9(114.1)	6.4	0.052	VI
OWENS VALLEY	72.1(116.0)	7.6	0.080	VII
SAN ANDREAS (Creeping)	72.7(117.0)	6.2	0.038	V
So. SIERRA NEVADA	74.5(119.9)	7.3	0.081	VII
ROUND VALLEY	75.2(121.0)	7.0	0.068	VI
SAN ANDREAS - Carrizo M-1c-2	75.9(122.2)	7.4	0.069	VI
GREAT VALLEY 10	77.0(124.0)	6.4	0.049	VI
FOOTHILLS FAULT SYSTEM 1	77.6(124.9)	6.5	0.051	VI
FOOTHILLS FAULT SYSTEM 2	78.6(126.5)	6.5	0.051	VI
WHITE WOLF	79.2(127.4)	7.3	0.077	VII
FOOTHILLS FAULT SYSTEM 3	80.0(128.7)	6.5	0.050	VI
WHITE MOUNTAINS	80.3(129.2)	7.4	0.066	VI
LITTLE LAKE	84.7(136.3)	6.9	0.049	VI
HILTON CREEK	85.4(137.4)	6.7	0.053	VI
HUNTER MTN. - SALINE VALLEY	85.6(137.7)	7.2	0.056	VI
FISH SLOUGH	85.7(137.9)	6.6	0.050	VI
GREAT VALLEY 9	86.6(139.4)	6.6	0.050	VI
RINCONADA	91.5(147.2)	7.5	0.063	VI
PLEITO THRUST	91.9(147.9)	7.0	0.058	VI
ORTIGALITA	92.5(148.8)	7.1	0.050	VI
HARTLEY SPRINGS	92.9(149.5)	6.6	0.047	VI
DEEP SPRINGS	93.6(150.7)	6.6	0.047	VI

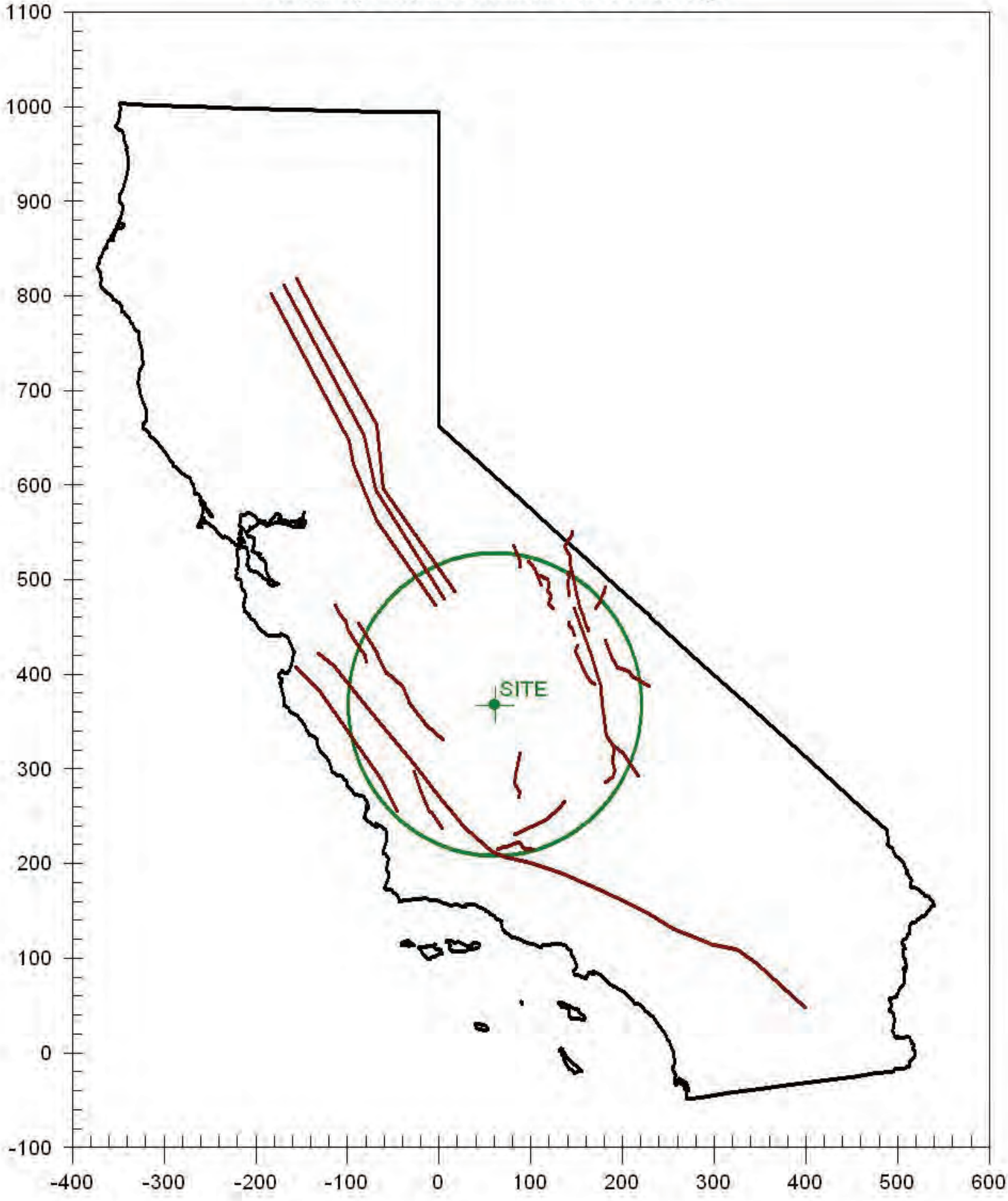
-END OF SEARCH- 34 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE Kern Front FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 32.9 MILES (53.0 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.1036 g

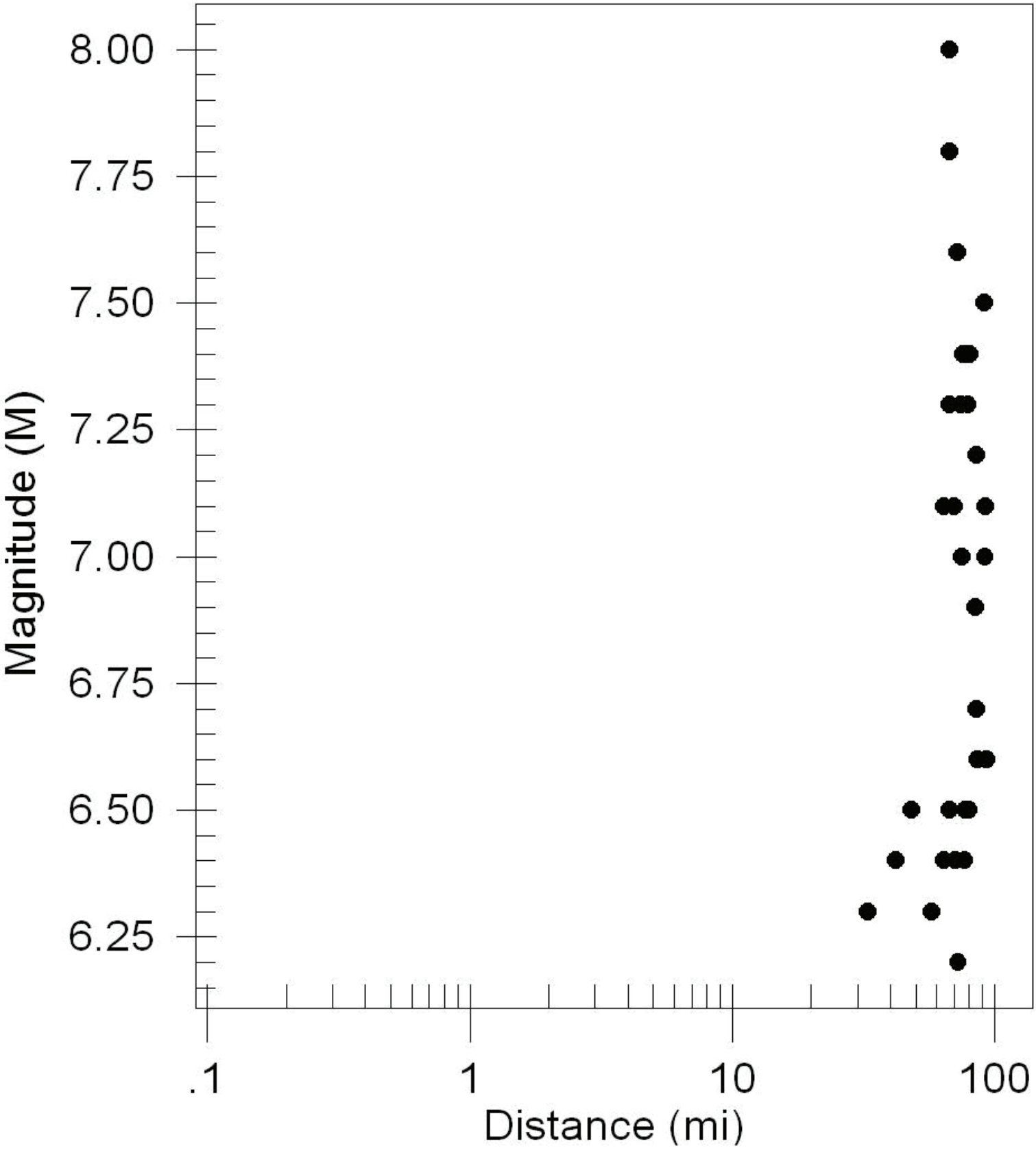
CALIFORNIA FAULT MAP

University Center & Student Union Buildings



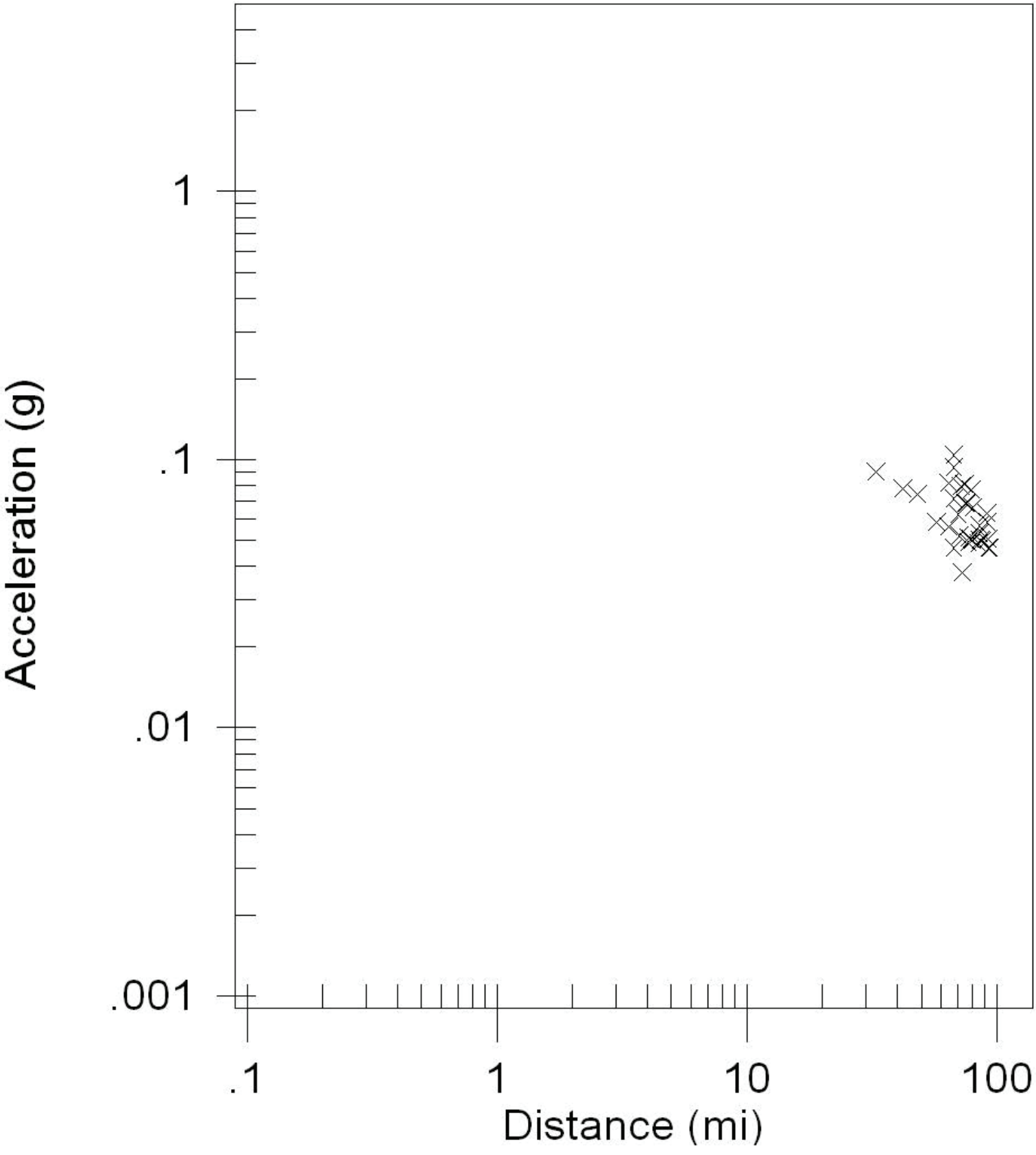
EARTHQUAKE MAGNITUDES & DISTANCES

University Center & Student Union Buildings



MAXIMUM EARTHQUAKES

University Center & Student Union Buildings



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*                        *
*     E Q S E A R C H    *
*                        *
*      Version 3.00      *
*                        *
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ESTIMATION OF
PEAK ACCELERATION FROM
CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: 19596

DATE: 04-19-2024

JOB NAME: University Center & Student Union Buildings

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT

SITE COORDINATES:
SITE LATITUDE: 36.3200
SITE LONGITUDE: 119.3153

SEARCH DATES:
START DATE: 1800
END DATE: 2010

SEARCH RADIUS:
100.0 mi
160.9 km

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
ASSUMED SOURCE TYPE: DS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
SCOND: 0 Depth Source: A
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km): 0.0

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
T-A	36.1700	119.3200	07/25/1868	230 0.0	0.0	5.00	0.107	VII	10.4(16.7)
DMG	36.0800	118.8200	05/29/1915	646 0.0	0.0	5.00	0.046	VI	32.2(51.8)
PAS	36.1510	120.0490	08/04/1985	12 156.0	6.0	5.80	0.056	VI	42.5(68.4)
BRK	36.2200	120.2600	09/09/1983	91614.0	0.0	5.40	0.039	V	53.0(85.3)
PAS	36.1820	120.2680	02/14/1987	72650.8	6.0	5.10	0.032	V	53.9(86.7)
MGI	36.6000	118.4000	09/04/1868	0 0 0.0	0.0	5.00	0.031	V	54.4(87.5)
BRK	36.2400	120.2900	05/09/1983	24912.0	0.0	5.20	0.034	V	54.5(87.7)
BRK	36.2200	120.2900	05/02/1983	234239.0	0.0	6.70	0.075	VII	54.7(88.0)
BRK	36.2200	120.2900	05/02/1983	2346 6.0	0.0	5.60	0.042	VI	54.7(88.0)
DMG	36.1700	120.3200	12/27/1926	919 0.0	0.0	5.00	0.030	V	56.9(91.6)
DMG	35.6000	118.8000	06/30/1926	1331 0.0	0.0	5.00	0.029	V	57.4(92.4)
BRK	36.2100	120.3800	07/25/1983	223140.0	0.0	5.10	0.030	V	59.8(96.2)
BRK	36.2600	120.4000	07/09/1983	74052.0	0.0	5.30	0.033	V	60.5(97.4)
BRK	36.2200	120.4000	07/22/1983	23955.0	0.0	6.00	0.048	VI	60.8(97.8)
BRK	36.2000	120.4000	07/22/1983	343 2.0	0.0	5.00	0.028	V	61.0(98.1)
PAS	36.2860	120.4130	10/25/1982	2226 4.0	6.0	5.60	0.038	V	61.1(98.4)
DMG	36.7000	118.3000	08/17/1896	1130 0.0	0.0	5.90	0.044	VI	62.1(100.0)
BRK	36.2500	120.4700	06/11/1983	3 954.0	0.0	5.10	0.028	V	64.4(103.7)
DMG	35.7500	120.2500	03/10/1922	112120.0	0.0	6.50	0.059	VI	65.4(105.2)
DMG	35.5000	118.7000	01/06/1905	1430 0.0	0.0	5.00	0.026	V	66.2(106.6)
DMG	35.8000	120.3300	06/05/1934	2148 0.0	0.0	5.00	0.026	V	67.1(107.9)
DMG	35.8000	120.3300	12/28/1939	121538.0	0.0	5.00	0.026	V	67.1(107.9)
DMG	35.8000	120.3300	06/08/1934	447 0.0	0.0	6.00	0.044	VI	67.1(107.9)
DMG	35.8000	120.3300	06/08/1934	430 0.0	0.0	5.00	0.026	V	67.1(107.9)
DMG	35.7500	120.3300	08/18/1922	512 0.0	0.0	5.00	0.025	V	69.0(111.0)
DMG	35.9500	120.4700	11/16/1956	323 9.0	0.0	5.00	0.025	V	69.3(111.5)
DMG	35.4000	118.8170	07/29/1952	8 146.0	0.0	5.10	0.027	V	69.4(111.6)
DMG	36.0000	120.5000	02/02/1881	011 0.0	0.0	5.60	0.035	V	69.6(112.1)
DMG	36.0000	120.5000	03/03/1901	745 0.0	0.0	5.50	0.033	V	69.6(112.1)
DMG	37.2000	118.7000	09/30/1889	520 0.0	0.0	5.60	0.035	V	69.6(112.1)
DMG	35.3830	118.8500	07/29/1952	7 347.0	0.0	6.10	0.045	VI	69.7(112.2)
GSB	35.9170	120.4650	12/20/1994	102747.2	8.0	5.00	0.025	V	69.9(112.5)
MGI	36.6000	118.1000	05/17/1872	21 0 0.0	0.0	5.00	0.025	V	70.2(113.0)
DMG	35.9300	120.4800	12/24/1934	1626 0.0	0.0	5.00	0.025	V	70.3(113.1)
DMG	35.9700	120.5000	06/28/1966	4 856.2	0.0	5.10	0.026	V	70.3(113.2)
DMG	35.9500	120.5000	06/28/1966	42613.4	0.0	5.50	0.032	V	70.8(114.0)
MGI	36.5800	118.0800	07/06/1917	11 1 0.0	0.0	5.70	0.036	V	70.9(114.1)
T-A	36.5800	118.0700	04/18/1872	0 0 0.0	0.0	5.00	0.025	V	71.4(115.0)
T-A	36.5800	118.0700	08/13/1882	0 0 0.0	0.0	5.00	0.025	V	71.4(115.0)
DMG	35.3330	118.9170	08/22/1952	224124.0	0.0	5.80	0.038	V	71.7(115.4)
DMG	36.7000	118.1000	03/26/1872	1030 0.0	0.0	7.80	0.107	VII	72.4(116.5)
DMG	35.9500	120.5300	06/29/1966	195325.9	0.0	5.00	0.025	V	72.4(116.5)
T-A	36.8300	118.1700	02/28/1895	825 0.0	0.0	5.00	0.024	V	72.6(116.8)
T-A	36.8300	118.1700	07/12/1871	330 0.0	0.0	5.00	0.024	V	72.6(116.8)
DMG	36.4000	118.0000	07/05/1871	21 6 0.0	0.0	5.20	0.027	V	73.3(118.0)
DMG	36.9000	118.2000	03/26/1872	14 6 0.0	0.0	6.50	0.053	VI	73.6(118.5)
DMG	36.9000	118.1900	11/28/1929	1949 0.0	0.0	5.50	0.031	V	74.1(119.3)
DMG	36.2300	120.6500	02/05/1947	614 0.0	0.0	5.00	0.024	V	74.5(120.0)
DMG	35.3000	119.8000	01/09/1857	16 0 0.0	0.0	7.90	0.109	VII	75.5(121.5)
DMG	35.3000	118.8000	12/23/1905	2223 0.0	0.0	5.00	0.024	IV	76.1(122.5)
DMG	35.3670	118.5830	07/23/1952	31923.0	0.0	5.00	0.023	IV	77.5(124.7)
DMG	35.3670	118.5830	07/23/1952	03832.0	0.0	6.10	0.042	V	77.5(124.7)
DMG	37.0000	118.2000	04/03/1872	1215 0.0	0.0	6.10	0.041	V	77.6(124.9)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
MGI	37.0000	118.1700	12/08/1929	1245 0.0	0.0	5.30	0.027	V	78.9(127.0)
MGI	37.0000	118.1700	12/02/1929	7 0 0.0	0.0	5.30	0.027	V	78.9(127.0)
DMG	35.3330	118.6000	07/31/1952	12 9 9.0	0.0	5.80	0.035	V	79.0(127.2)
DMG	35.7780	118.0490	01/28/1961	81246.2	5.5	5.30	0.027	V	80.0(128.7)
DMG	35.7150	118.0740	03/15/1946	14 035.4	0.0	5.30	0.026	V	80.9(130.2)
DMG	35.2170	118.8170	07/23/1952	1317 5.0	0.0	5.70	0.032	V	81.1(130.5)
DMG	35.7250	118.0550	03/15/1946	134935.9	22.0	6.30	0.044	VI	81.5(131.1)
DMG	35.7450	118.0390	03/16/1946	94617.9	0.0	5.10	0.024	IV	81.6(131.3)
GSP	35.1490	119.1040	05/28/1993	044740.6	21.0	5.20	0.025	V	81.7(131.5)
DMG	35.7510	118.0290	03/15/1946	215433.4	0.0	5.20	0.025	V	81.9(131.7)
DMG	35.3150	118.5160	07/25/1952	194323.7	11.2	5.70	0.032	V	82.6(132.9)
DMG	37.3500	118.5500	08/04/1959	73659.0	0.0	5.20	0.025	V	82.7(133.1)
DMG	35.3170	118.4940	07/25/1952	19 944.6	5.5	5.70	0.032	V	83.1(133.8)
DMG	35.3110	118.4990	07/25/1952	1313 8.2	2.8	5.00	0.022	IV	83.3(134.1)
PAS	37.5090	119.0430	06/11/1980	441 1.1	14.1	5.00	0.022	IV	83.5(134.3)
PAS	37.4640	118.8230	05/27/1980	145057.1	2.4	6.30	0.044	VI	83.5(134.4)
DMG	37.4170	118.6670	02/02/1961	0 742.0	0.0	5.10	0.023	IV	83.8(134.8)
DMG	35.7530	117.9860	03/15/1946	1321 0.9	0.0	5.20	0.024	V	83.9(135.0)
DMG	36.6000	120.8000	07/25/1926	175749.0	15.0	5.00	0.022	IV	84.7(136.3)
USG	37.4980	118.8380	06/06/1980	141817.2	2.0	5.27	0.025	V	85.5(137.6)
DMG	37.3300	118.4200	05/06/1910	1640 0.0	0.0	5.50	0.028	V	85.5(137.6)
DMG	37.3300	118.4200	01/05/1912	354 0.0	0.0	5.50	0.028	V	85.5(137.6)
PAS	37.4230	118.6080	11/23/1984	191235.3	6.0	5.40	0.027	V	85.6(137.7)
DMG	35.7140	117.9770	03/15/1946	191853.6	0.0	5.40	0.027	V	85.6(137.8)
PAS	37.4860	118.7830	05/25/1980	164930.3	4.7	5.80	0.033	V	85.7(137.9)
PAS	37.4490	118.6530	11/26/1984	162141.4	6.0	5.50	0.028	V	86.1(138.6)
DMG	37.4500	118.6330	02/02/1961	0 416.0	0.0	5.30	0.025	V	86.6(139.4)
UNR	37.5160	118.8370	06/18/1980	185537.7	6.3	5.30	0.025	V	86.7(139.5)
DMG	35.1830	118.6500	07/21/1952	151358.0	0.0	5.10	0.022	IV	86.9(139.8)
DMG	35.2330	118.5330	07/21/1952	174244.0	0.0	5.10	0.022	IV	86.9(139.9)
DMG	37.5000	118.7500	09/18/1927	2 7 7.0	0.0	6.00	0.036	V	87.2(140.4)
DMG	35.1330	118.7670	07/21/1952	194122.0	0.0	5.50	0.028	V	87.5(140.9)
DMG	37.4530	118.6040	12/03/1938	174252.6	10.0	5.70	0.031	V	87.5(140.9)
USG	37.5420	118.8830	06/05/1980	20 452.3	1.6	5.05	0.022	IV	87.7(141.1)
UNR	37.5360	118.8510	06/20/1980	152459.6	8.7	5.30	0.025	V	87.8(141.3)
GSG	37.5290	118.8170	05/15/1999	132210.7	5.0	5.60	0.029	V	87.9(141.4)
DMG	35.7470	117.9080	03/18/1946	155042.6	4.4	5.30	0.025	V	88.0(141.6)
PAS	37.5540	118.8970	08/01/1980	163856.3	4.7	5.40	0.026	V	88.3(142.1)
UNR	37.5580	118.9110	06/19/1980	71931.5	0.4	5.00	0.021	IV	88.3(142.2)
PAS	37.5170	118.7430	05/26/1980	122427.3	2.0	5.20	0.023	IV	88.5(142.4)
DMG	37.5170	118.7330	06/05/1960	747 7.0	0.0	5.20	0.023	IV	88.7(142.7)
PAS	37.4480	118.5450	03/25/1985	16 513.6	6.0	5.00	0.021	IV	88.7(142.8)
PAS	37.4700	118.5970	11/23/1984	18 825.6	6.0	6.20	0.039	V	88.8(142.8)
USG	37.5270	118.7590	06/08/1980	61139.6	1.3	5.12	0.022	IV	88.8(142.9)
USG	37.5610	118.8740	08/01/1980	164745.9	1.9	5.15	0.023	IV	89.1(143.3)
DMG	35.1500	118.6330	01/27/1954	141948.0	0.0	5.00	0.021	IV	89.4(143.8)
PAS	37.5140	118.6830	10/04/1978	164248.7	5.6	5.80	0.032	V	89.5(144.1)
PAS	37.5560	118.7910	05/25/1980	194452.2	6.4	6.50	0.046	VI	90.1(145.0)
PAS	37.5370	118.7130	05/25/1980	203551.0	5.0	5.50	0.027	V	90.4(145.4)
GSG	37.5640	118.8050	07/15/1998	045319.2	6.0	5.10	0.022	IV	90.4(145.5)
PAS	37.5380	118.6750	10/04/1978	1739 3.3	6.3	5.30	0.024	V	91.2(146.8)
MGI	35.5000	120.6000	01/01/1830	0 0 0.0	0.0	5.00	0.020	IV	91.5(147.2)
DMG	37.5670	118.7330	12/31/1941	64844.0	0.0	5.40	0.025	V	91.9(147.9

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	37.5670	118.7330	09/14/1941	183911.9	0.0	6.00	0.035	V	91.9(147.9)
DMG	37.5670	118.7330	09/14/1941	164331.8	0.0	5.80	0.031	V	91.9(147.9)
DMG	37.5670	118.7330	09/14/1941	2116 1.0	0.0	5.00	0.020	IV	91.9(147.9)
DMG	37.5670	118.7330	09/14/1941	182118.7	0.0	5.50	0.027	V	91.9(147.9)
DMG	36.0000	120.9200	11/02/1955	1940 6.0	0.0	5.20	0.023	IV	92.1(148.3)
GSB	37.5890	118.7950	06/09/1998	052440.2	6.0	5.20	0.023	IV	92.2(148.4)
DMG	35.0000	119.0330	07/21/1952	12 2 0.0	0.0	5.60	0.028	V	92.5(148.9)
DMG	35.0000	119.0170	01/12/1954	233349.0	0.0	5.90	0.033	V	92.7(149.1)
DMG	35.0000	119.0170	07/21/1952	115214.0	0.0	7.70	0.084	VII	92.7(149.1)
DMG	35.0000	119.0000	07/21/1952	12 531.0	0.0	6.40	0.042	VI	92.8(149.4)
DMG	35.0000	119.0000	02/16/1919	1557 0.0	0.0	5.00	0.020	IV	92.8(149.4)
PAS	37.6080	118.8210	05/25/1980	163344.8	3.7	6.40	0.042	VI	93.0(149.7)
PAS	37.6220	118.8810	09/30/1981	115327.0	6.0	5.80	0.031	V	93.0(149.7)
DMG	35.8310	117.7610	10/19/1961	5 943.9	-2.0	5.20	0.022	IV	93.1(149.8)
DMG	37.5000	118.5000	04/11/1872	19 0 0.0	0.0	6.60	0.047	VI	93.1(149.8)
PAS	37.6040	118.7700	05/27/1980	19 1 8.3	3.8	5.00	0.020	IV	93.6(150.7)
DMG	36.4000	121.0000	04/12/1885	4 5 0.0	0.0	6.20	0.038	V	93.8(151.0)
DMG	34.9830	118.9830	05/23/1954	235243.0	0.0	5.10	0.021	IV	94.2(151.6)
GSP	36.0750	117.6500	11/27/1996	201724.1	1.0	5.30	0.023	IV	94.3(151.8)
PAS	37.6640	119.0080	01/07/1983	32419.1	5.0	5.60	0.027	V	94.3(151.8)
UNR	37.6360	118.8470	06/19/1980	14430.2	8.3	5.20	0.022	IV	94.5(152.0)
PAS	37.6560	118.9290	01/07/1983	13810.6	5.7	5.70	0.029	V	94.7(152.3)
DMG	35.0000	118.8330	07/23/1952	181351.0	0.0	5.20	0.022	IV	95.1(153.0)
DMG	35.0000	118.8330	07/23/1952	75319.0	0.0	5.40	0.024	V	95.1(153.0)
GSP	36.0670	117.6380	03/06/1998	054740.3	1.0	5.20	0.022	IV	95.1(153.0)
DMG	37.5670	118.5830	12/28/1951	24927.0	0.0	5.20	0.022	IV	95.1(153.1)
PAS	37.4730	118.3720	07/31/1986	72240.5	6.0	5.90	0.032	V	95.1(153.1)
GSP	36.0760	117.6180	03/07/1998	003646.8	1.0	5.00	0.020	IV	96.1(154.6)
DMG	36.0000	121.0000	02/26/1932	1658 0.0	0.0	5.00	0.020	IV	96.5(155.3)
DMG	34.9410	118.9870	11/15/1961	53855.5	10.7	5.00	0.020	IV	97.0(156.1)
PAS	37.5420	118.4440	07/21/1986	144226.7	6.0	5.90	0.031	V	97.1(156.3)
DMG	34.9320	118.9760	03/01/1963	02557.9	13.9	5.00	0.019	IV	97.7(157.2)
DMG	34.9500	118.8670	07/21/1952	121936.0	0.0	5.30	0.023	IV	97.9(157.5)
T-A	34.9200	118.9200	05/23/1857	0 0 0.0	0.0	5.00	0.019	IV	99.2(159.6)
T-A	34.9200	118.9200	01/20/1857	0 0 0.0	0.0	5.00	0.019	IV	99.2(159.6)
MGI	35.2500	120.5000	07/10/1917	045 0.0	0.0	5.30	0.022	IV	99.3(159.8)
MGI	35.2500	120.5000	07/09/1917	2238 0.0	0.0	5.30	0.022	IV	99.3(159.8)
MGI	35.2500	120.5000	07/10/1917	043 0.0	0.0	5.30	0.022	IV	99.3(159.8)
MGI	35.2500	120.5000	07/09/1917	2222 0.0	0.0	5.00	0.019	IV	99.3(159.8)
PAS	37.5830	118.4500	07/20/1986	142946.3	6.0	5.90	0.031	V	99.4(160.0)
GSB	37.0640	117.7770	05/18/1993	234853.9	3.0	5.20	0.021	IV	99.5(160.0)
GSP	35.7760	117.6620	08/17/1995	223959.0	5.0	5.40	0.024	IV	99.6(160.3)

****

-END OF SEARCH- 148 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH: 1800 TO 2010

LENGTH OF SEARCH TIME: 211 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 10.4 MILES (16.7 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 7.9

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.109 g

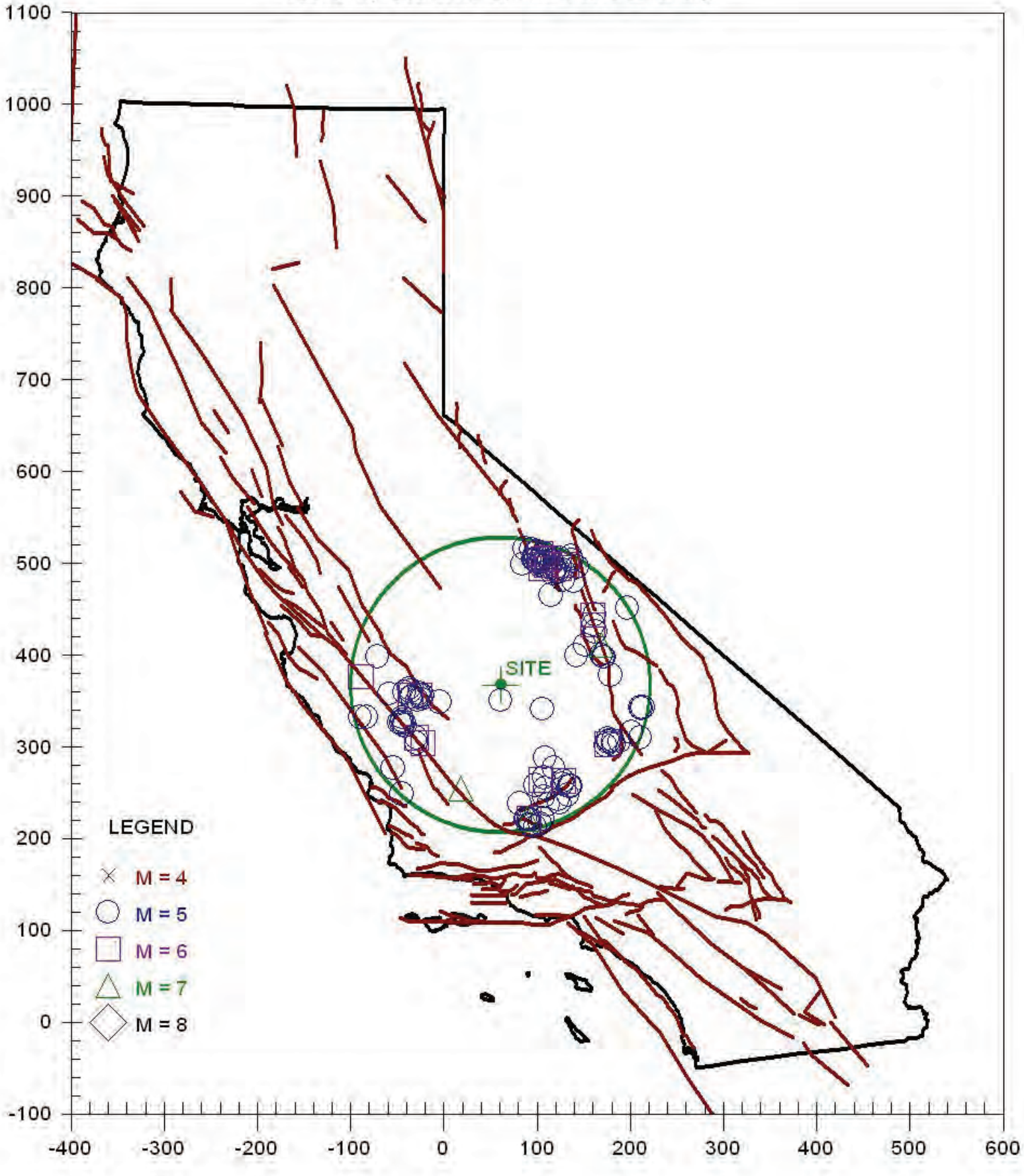
COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:
a-value= 1.716
b-value= 0.425
beta-value= 0.979

TABLE OF MAGNITUDES AND EXCEEDANCES:

Earthquake Magnitude	Number of Times Exceeded	Cumulative No. / Year
4.0	148	0.70476
4.5	148	0.70476
5.0	148	0.70476
5.5	55	0.26190
6.0	21	0.10000
6.5	8	0.03810
7.0	3	0.01429
7.5	3	0.01429

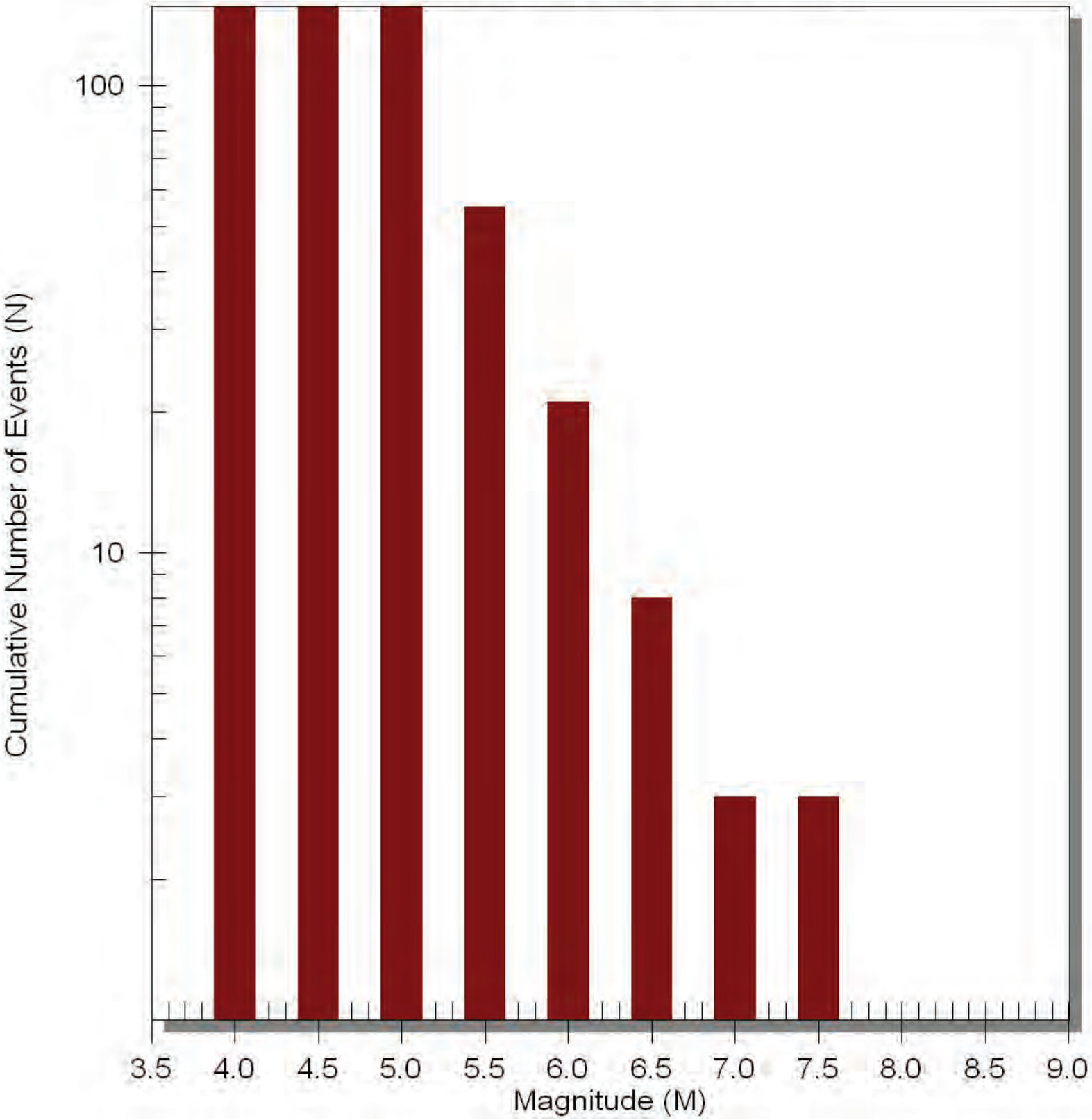
EARTHQUAKE EPICENTER MAP

University Center & Student Union Buildings



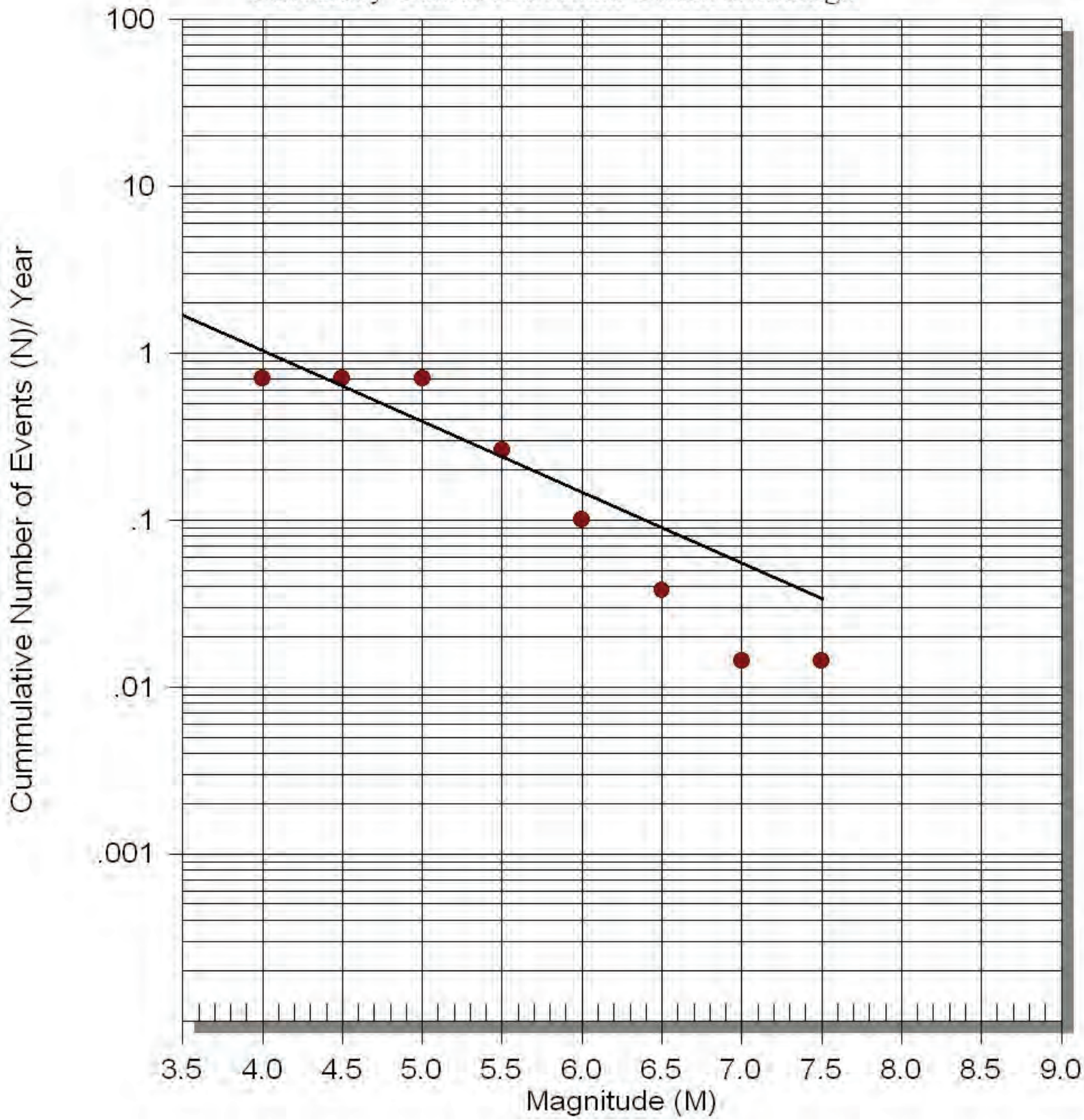
Number of Earthquakes (N) Above Magnitude (M)

University Center & Student Union Buildings



EARTHQUAKE RECURRENCE CURVE

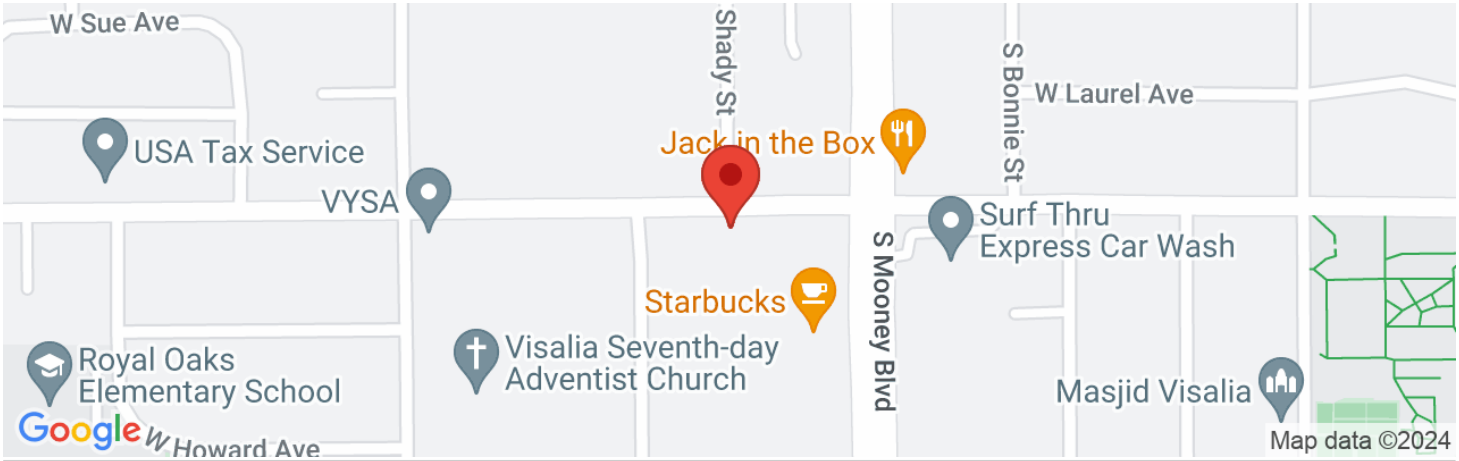
University Center & Student Union Buildings



USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
USGS web services are now operational so this tool should work as expected.

19596 COS

Latitude, Longitude: 36.32004, -119.315290



Date	4/1/2024, 4:45:25 PM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.553	MCE_R ground motion. (for 0.2 second period)
S_1	0.219	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.751	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.5	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.358	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.24	MCE_G peak ground acceleration
F_{PGA}	1.36	Site amplification factor at PGA
PGA_M	0.327	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.553	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.596	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.219	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.233	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.24	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.928	Mapped value of the risk coefficient at short periods
C_{R1}	0.94	Mapped value of the risk coefficient at a period of 1 s

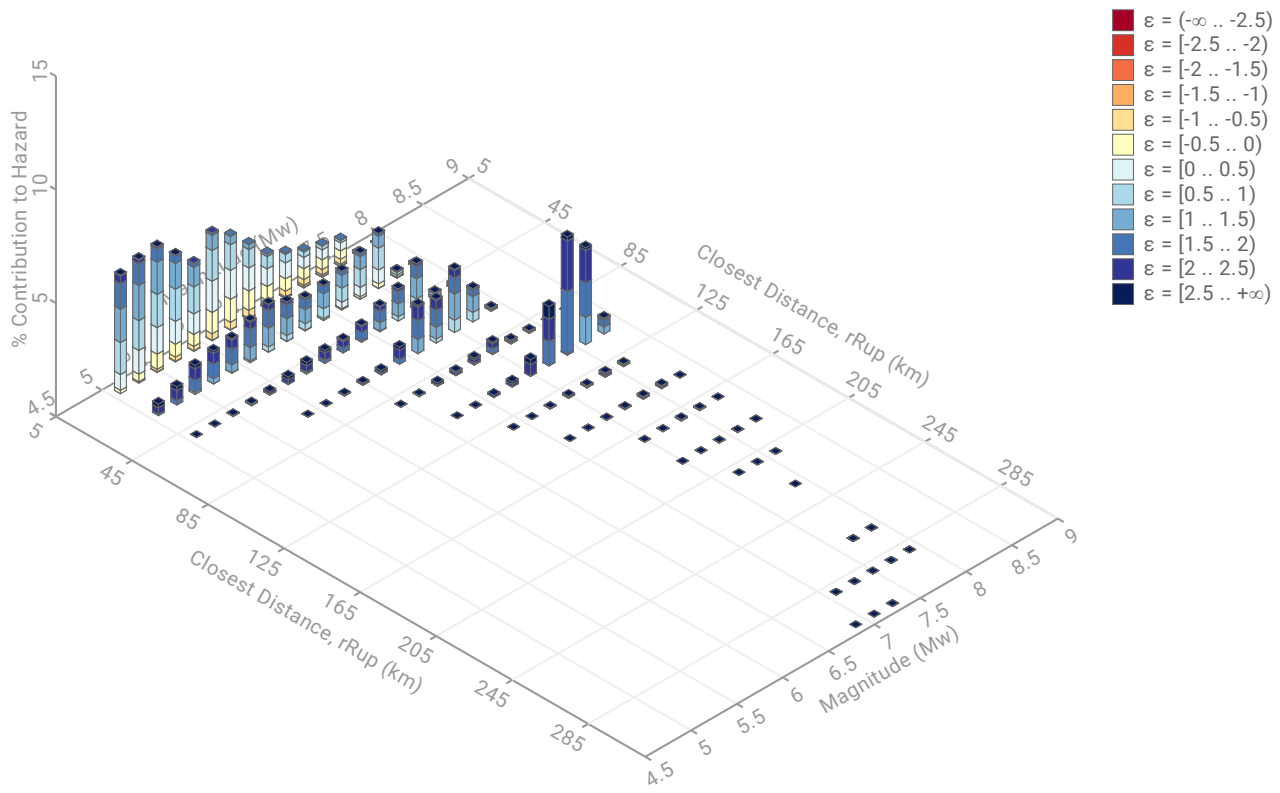
Type	Value	Description
C_V	1.069	Vertical coefficient

DISCLAIMER

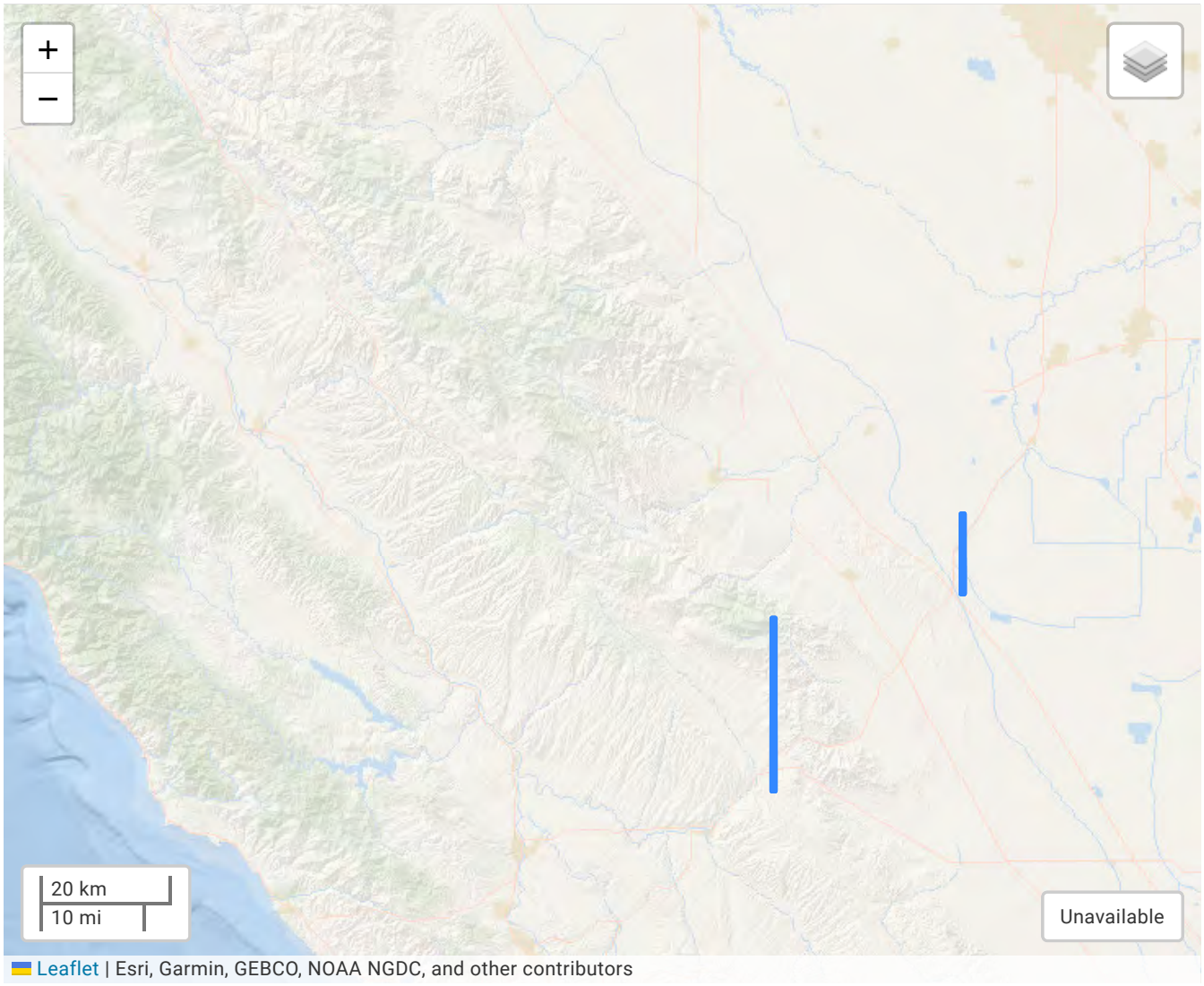
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Disaggregation Report

Disaggregation



Geographical Disaggregation



Parameter Summary

Model: NSHM Conterminous U.S. 2023 (beta)

Latitude: 36.32004°

Longitude: -119.31529°

Site Class: D (Vs30 260)

Intensity Measure Type: PGA

Return Period: 2475 (2% in 50)

Component: Total

Disaggregation Summary

Disaggregation targets

Return period : 2475 yrs

Exceedance rate : 4.040e-4 yr^{-1}

PGA ground motion : 3.249e-1 g

Recovered targets

Return period : 2449.4207 yrs

Exceedance rate : 4.083e-4 yr^{-1}

Totals

Binned : 100 %

Residual : 0 %

Trace : 0.28 %

Mean (over all sources)

m : 6.61

r : 39.01 km

ε_0 : 1.14 σ

Mode (largest m-r bin)

m : 5.5

r : 11.15 km

ε_0 : 0.74 σ

Contribution : 5.53 %

Mode (largest m-r-ε_0 bin)

m : 7.89

r : 109.12 km

ε_0 : 1.74 σ

Contribution : 2.76 %

Discretization

r : min = 0.0, max = 1000.0, Δ = 20.0 km

m : min = 4.4, max = 9.4, Δ = 0.2

ε : min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0 : [-∞ .. -2.5)

ε1 : [-2.5 .. -2.0)

ε2 : [-2.0 .. -1.5)

ε3 : [-1.5 .. -1.0)

ε4 : [-1.0 .. -0.5)

ε5 : [-0.5 .. 0.0)

ε6 : [0.0 .. 0.5)

ε7 : [0.5 .. 1.0)

ε8 : [1.0 .. 1.5)

ε9 : [1.5 .. 2.0)

ε10 : [2.0 .. 2.5)

ε11 : [2.5 .. +∞]

Disaggregation Contributions

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
WUS Branch Average (opt)	Grid							78.94
PointSourceFinite: -119.315, 36.396		8.79	5.79	0.40	119.315°W	36.396°N	0.00	1.64
PointSourceFinite: -119.315, 36.396		9.93	5.80	0.45	119.315°W	36.396°N	0.00	1.49
PointSourceFinite: -119.315, 36.378		7.43	5.74	0.25	119.315°W	36.378°N	0.00	1.42
PointSourceFinite: -119.315, 36.405		9.50	5.82	0.47	119.315°W	36.405°N	0.00	1.42
PointSourceFinite: -119.315, 36.414		10.17	5.87	0.59	119.315°W	36.414°N	0.00	1.4
PointSourceFinite: -119.315, 36.423		10.89	5.90	0.65	119.315°W	36.423°N	0.00	1.31
PointSourceFinite: -119.315, 36.378		8.53	5.75	0.31	119.315°W	36.378°N	0.00	1.3
PointSourceFinite: -119.315, 36.405		10.66	5.83	0.52	119.315°W	36.405°N	0.00	1.29
PointSourceFinite: -119.315, 36.387		8.09	5.76	0.33	119.315°W	36.387°N	0.00	1.28
PointSourceFinite: -119.315, 36.370		6.79	5.71	0.18	119.315°W	36.370°N	0.00	1.28
PointSourceFinite: -119.315, 36.414		11.37	5.88	0.63	119.315°W	36.414°N	0.00	1.27
PointSourceFinite: -119.315, 36.441		12.37	5.97	0.76	119.315°W	36.441°N	0.00	1.22
PointSourceFinite: -119.315, 36.432		11.63	5.93	0.70	119.315°W	36.432°N	0.00	1.22
PointSourceFinite: -119.315, 36.423		12.11	5.91	0.69	119.315°W	36.423°N	0.00	1.19
PointSourceFinite: -119.315, 36.370		7.86	5.72	0.23	119.315°W	36.370°N	0.00	1.17
PointSourceFinite: -119.315, 36.387		9.23	5.77	0.38	119.315°W	36.387°N	0.00	1.17
PointSourceFinite: -119.315, 36.352		5.67	5.67	0.03	119.315°W	36.352°N	0.00	1.13
PointSourceFinite: -119.315, 36.459		13.86	6.03	0.86	119.315°W	36.459°N	0.00	1.12
PointSourceFinite: -119.315, 36.441		13.61	5.98	0.80	119.315°W	36.441°N	0.00	1.1
PointSourceFinite: -119.315, 36.432		12.86	5.95	0.75	119.315°W	36.432°N	0.00	1.1
PointSourceFinite: -119.315, 36.477		15.36	6.09	0.95	119.315°W	36.477°N	0.00	1.08
PointSourceFinite: -119.315, 36.352		6.59	5.68	0.07	119.315°W	36.352°N	0.00	1.06
PointSourceFinite: -119.315, 36.450		13.11	6.00	0.81	119.315°W	36.450°N	0.00	1.03
PointSourceFinite: -119.315, 36.459		15.11	6.04	0.89	119.315°W	36.459°N	0.00	1.02
PointSourceFinite: -119.315, 36.468		14.61	6.06	0.91	119.315°W	36.468°N	0.00	1
WUS Branch Average	FaultSystem							21.06
San Andreas (Cholame) (9)		108.72	7.93	1.95	120.261°W	35.712°N	231.79	11.78
Great Valley 14 (Kettleman Hills) (1)		68.56	7.39	1.41	119.944°W	35.981°N	236.40	5.4

Application Metadata

Application: Disaggregation
URL: https://earthquake.usgs.gov/nshmp/hazard/disagg

Repository: nshmp-apps
Version: 1.1.0
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-apps

Repository : nshmp-haz
Version: 2.4.8
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-haz

Repository : nshmp-lib
Version: 1.4.16
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-lib

Repository : nshmp-utils-java
Version: 0.4.0
URL: https://code.usgs.gov/ghsc/nshmp/nshmp-utils-java

Repository : nshm-conus
Version: 6.b.3
URL: https://code.usgs.gov/ghsc/nshmp/nshms/nshm-conus

April 01, 2024, 04:47 PM

Appendix B

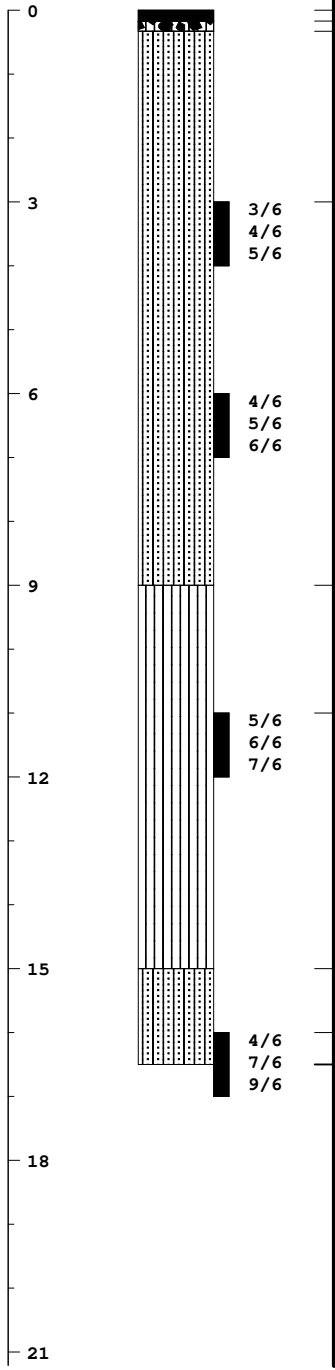
Boring Logs, the Flood Insurance Rate Map, Historical Depth to Water Map, LiquefyPro plot and calculation sheet for liquefaction and settlement. Lab Result Table. National Pipeline Map.

Boring Location Map
Figure 1
SEI File No. 24-19596



LOG OF TEST BORING
BORING B-1

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/20/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/20/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/20/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*

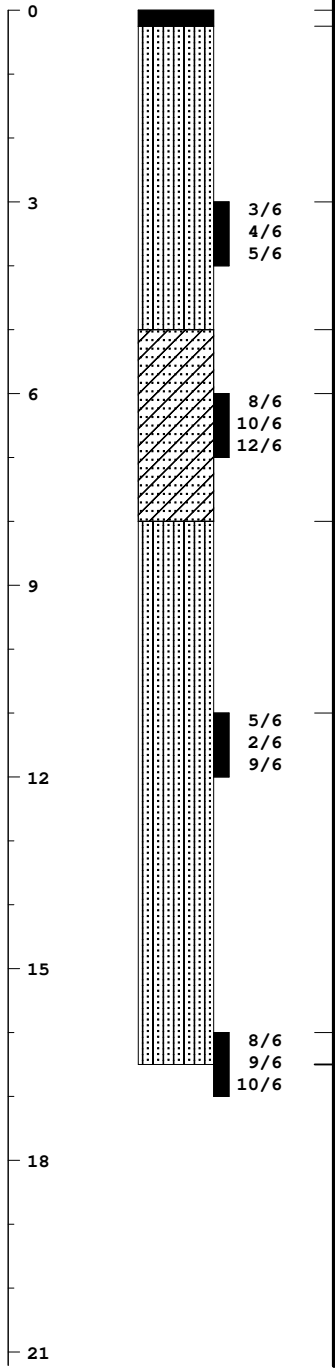


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		GM	Approx. 2 inches asphaltic concrete.			
		SM	Approx. 2 inches aggregate base.			
3	3/6 4/6 5/6		SILTY SAND; brown, moist, fine, cohesive. Loose.		102.0	14.7
6	4/6 5/6 6/6				105.9	7.3
9		ML	SANDY SILT; brown, moist.			
12	5/6 6/6 7/6		Stiff.		108.8	13.5
15		SM	SILTY SAND; light brown, damp, fine, cohesive.			
	4/6 7/6 9/6		Medium dense.		110.3	13.8
18			BOTTOM.			
21						

Figure Number 2

LOG OF TEST BORING
BORING B-2

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/20/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/20/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/20/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*
LOGGER: *LW*

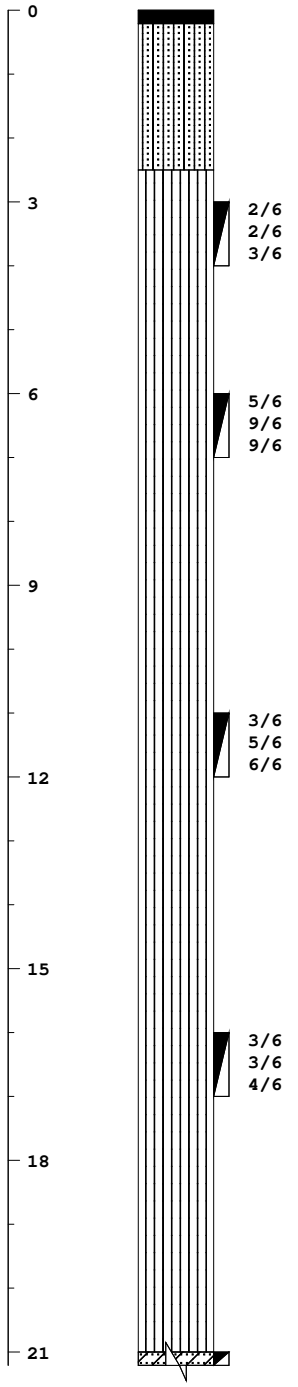


ELEVATION/ DEPTH (feet)	USCS	Description	Remarks	Density pcf	Moisture %
0	SM	Approx. 3 inches asphaltic concrete. SILTY SAND; brown, moist, cohesive.			
3		Loose.		113.3	13.8
6	SC	CLAYEY SAND; brown, moist, low plasticity. Medium dense.		115.7	13.3
9	SM	SILTY SAND; brown, damp to moist, cohesive, fine.			
12		Loose.		110.3	12.7
15		Medium dense.		104.0	22.1
18		BOTTOM.			
21					

Figure Number 3

LOG OF TEST BORING
BORING B-3

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*
LOGGER: *LW*

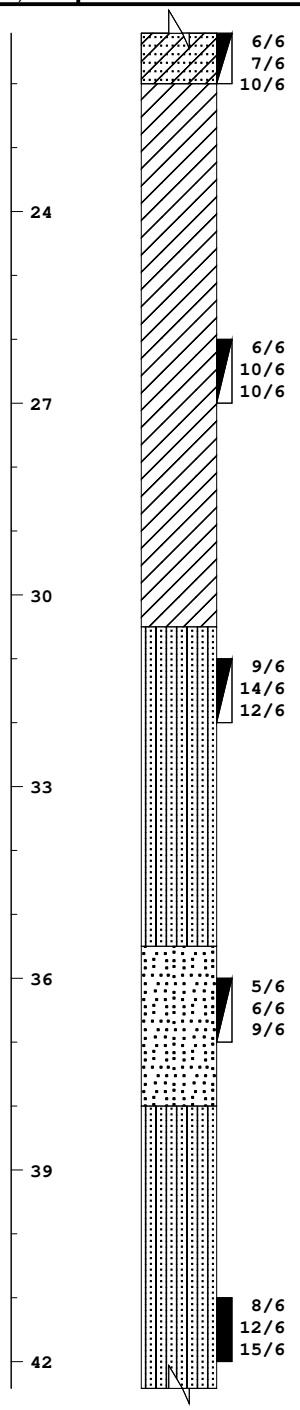


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SM	Approx. 2.5 inches asphaltic concrete. Rock sand below AC.			
		ML	SILTY SAND; yellowish brown, damp, cohesive.			
3	2/6 2/6 3/6		SANDY SILT; brown, moist. Medium stiff.			16.9
6	5/6 9/6 9/6		Very stiff.			14.5
9		ML	SANDY SILT; yellowish brown, moist, fine, cohesive.			
12	3/6 5/6 6/6		Stiff.			11.5
15	3/6 3/6 4/6		Medium stiff.			15.0
18						
21						

Figure Number 4

LOG OF TEST BORING
BORING B-3

PROJECT: *University Center & Student Union Buildings* **FILE NO:** *19596*
BORING DATE: *03/25/24* **ELEV.:**
BORING LOCATION: *See Boring Location Map, Figure 1* **START:** *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger* **FINISH:** *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A* **LOGGER:** *LW*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SC	CLAYEY SAND; olive brown, moist, medium plasticity.			12.6
		CL	SANDY CLAY; olive brown, moist, medium plasticity.			
			Very stiff.			19.0
		SM	SILTY SAND; light brown, damp, fine, cohesive, traces of clay. Medium dense.			9.3
		SP	POORLY GRADED SAND; light yellowish brown, fine grained.			5.5
		SM	SILTY SAND; light brown, damp to moist, fine to medium grained, traces of clay.			
			Medium dense.			5.6

Figure Number 4

LOG OF TEST BORING
BORING B-3

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▽ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
45		ML	SANDY SILT; yellowish brown, moist, traces of clay.			
	6/6 11/6 17/6		Very stiff.			18.2
48		SM	SILTY SAND; brown, moist, fine to medium grained.			
51	8/6 13/6 15/6		Medium dense.			4.5
			BOTTOM.			
54						
57						
60						
63						

Figure Number 4

LOG OF TEST BORING
BORING B-4

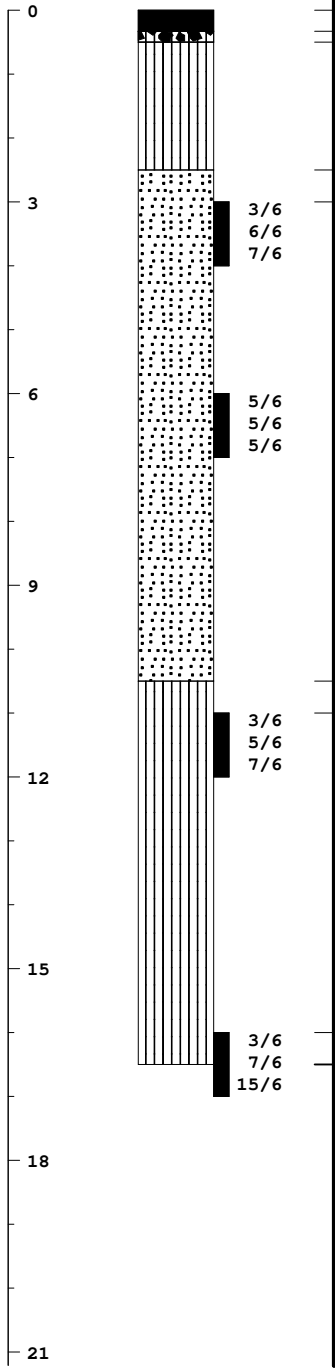
PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *MW*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		GM	Approx. 4 inches asphaltic concrete.			
		ML	Approx. 2 inches aggregate base.			
3	3/6 3/6 3/6		SILT; dark brown, damp, low plasticity. Firm.		111.6	16.0
6	3/6 6/6 9/6		Brown, stiff.		109.3	13.1
9						
12	6/6 6/6 7/6		Medium stiff.		112.5	14.8
15	7/6 8/6 9/6		Stiff.		106.4	17.7
			BOTTOM.			
18						
21						

Figure Number 5

LOG OF TEST BORING
BORING B-5

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *MW*

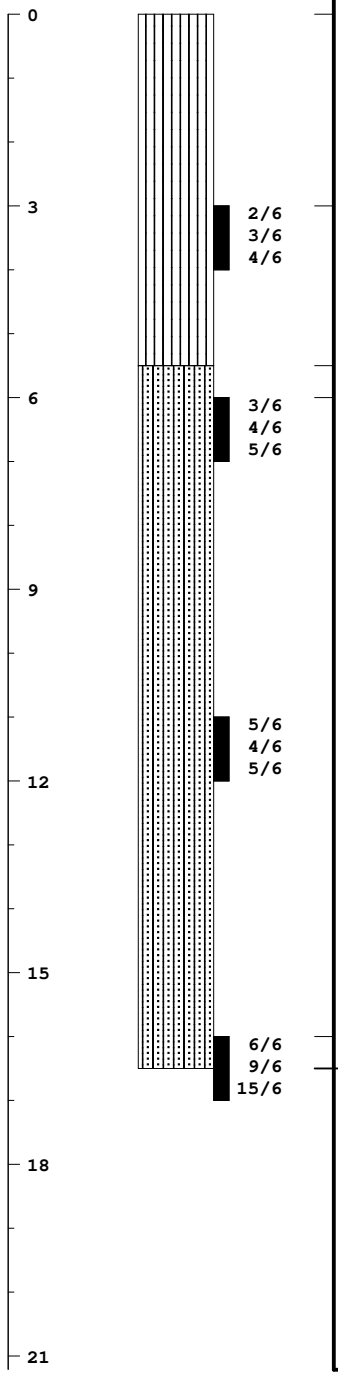


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		GM	Approx. 4 inches asphaltic concrete.			
		ML	Approx. 2 inches aggregate base.			
		SP	SILT; brown, damp.			
	3/6 6/6 7/6		POORLY GRADED SAND; light yellowish brown, dry, fine grained. Loose.		94.8	2.2
	5/6 5/6 5/6				96.4	2.8
	3/6 5/6 7/6	ML	SILT; brown, damp, low plasticity. Medium stiff.		116.7	13.5
	3/6 7/6 15/6		Stiff. BOTTOM.		115.7	16.5

Figure Number 6

LOG OF TEST BORING
BORING B-6

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ⬟ **:** *N/A*
LOGGER: *MW*

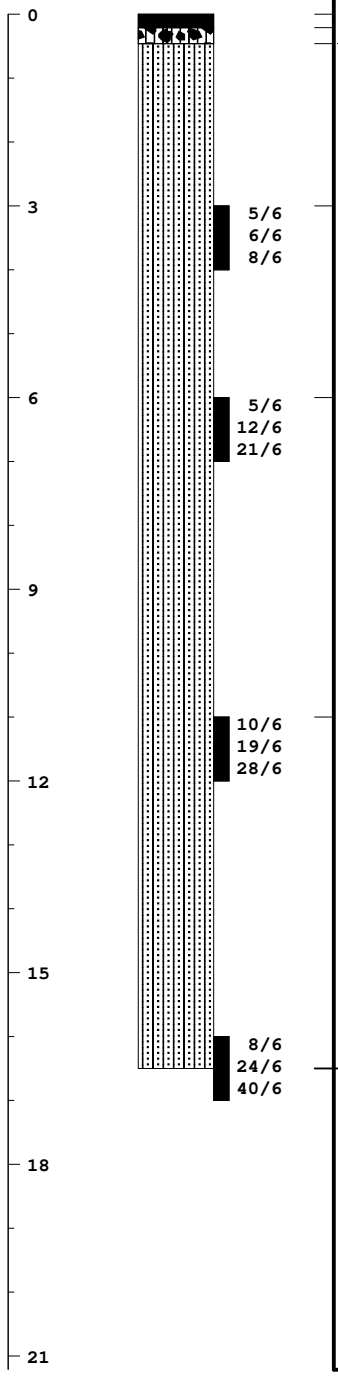


ELEVATION/ DEPTH (feet)	USCS	Description	Remarks	Density pcf	Moisture %
0	ML	SILT; dark brown, damp, low plasticity.			
3		Firm.		103.8	14.4
6	SM	SILTY SAND; yellowish brown, damp, fine grained. Loose.		113.8	9.3
12				112.1	16.2
15		Medium dense.		112.9	16.5
		BOTTOM.			
18					
21					

Figure Number 7

LOG OF TEST BORING
BORING B-7

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*
LOGGER: *LW*

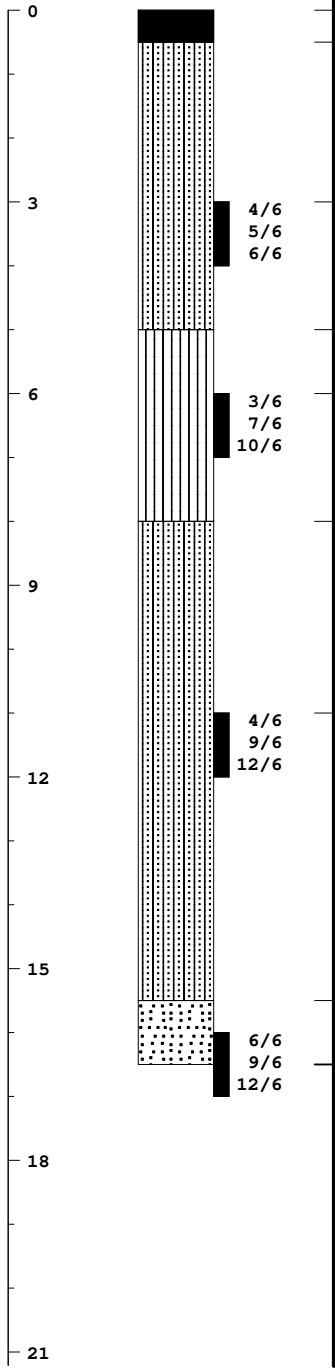


ELEVATION/ DEPTH (feet)	USCS	Description	Remarks	Density pcf	Moisture %
0	GM	Approx. 2.5 inches asphaltic concrete.			
	SM	Approx. 3 inches aggregate base.			
3		SILTY SAND; dark brown, with low plasticity clay, moist. Medium stiff.		106.3	14.3
6		Light brown, Medium dense, traces of clay.		114.9	6.6
12		Hard.		116.8	5.0
		BOTTOM.		114.2	6.0

Figure Number 8

LOG OF TEST BORING
BORING B-8

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *3/26/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *3/26/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *3/26/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▽ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*

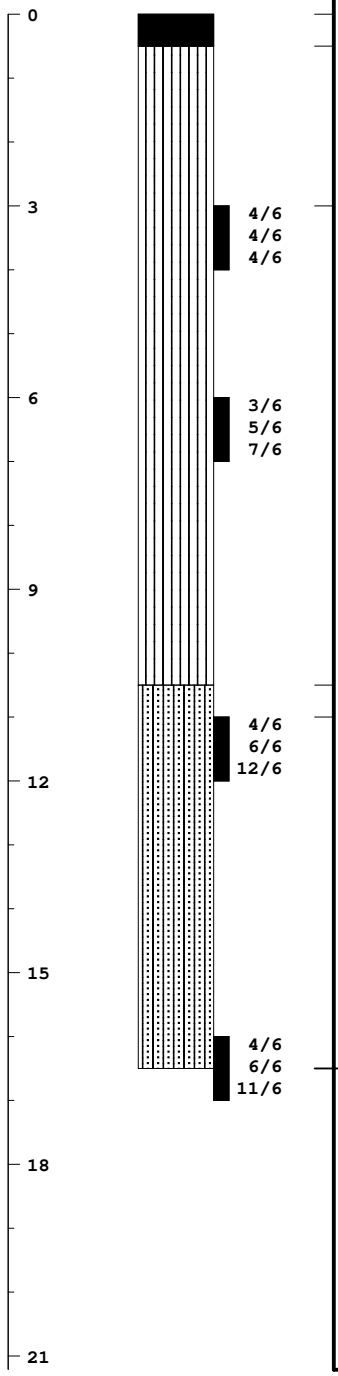


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SM	Approx. 6 inches concrete with 1/8 inch wire mesh. SILTY SAND; dark brown, moist, fine grained, cohesive.			
			Loose.		116.2	7.5
		ML	SANDY SILT; dark brown, moist.			
			Stiff.		119.0	10.6
		SM	SILTY SAND; yellowish brown, moist, fine, cohesive.			
			Medium dense.		113.1	5.4
		SP	POORLY GRADED SAND; yellowish brown, damp, fine grained.		103.7	2.3
			BOTTOM.			

Figure Number 9

LOG OF TEST BORING
BORING B-10

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *3/26/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *3/26/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *3/26/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ⬟ **:** *N/A*
LOGGER: *LW*

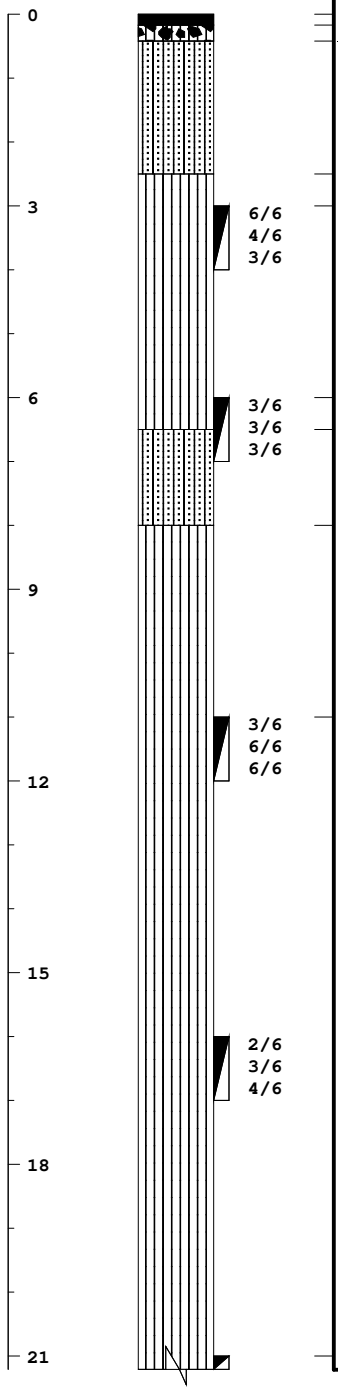


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		ML	Approx. 6 inches concrete with tree roots directly below. SANDY SILT; dark brown, damp to moist. Medium stiff.		111.0	10.5
					118.6	10.9
		SM	SILTY SAND; yellowish brown, moist, fine grained, cohesive. Medium dense.		117.0	7.7
			BOTTOM.		111.2	11.5

Figure Number 11

LOG OF TEST BORING
BORING B-11

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/26/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/26/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/26/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*

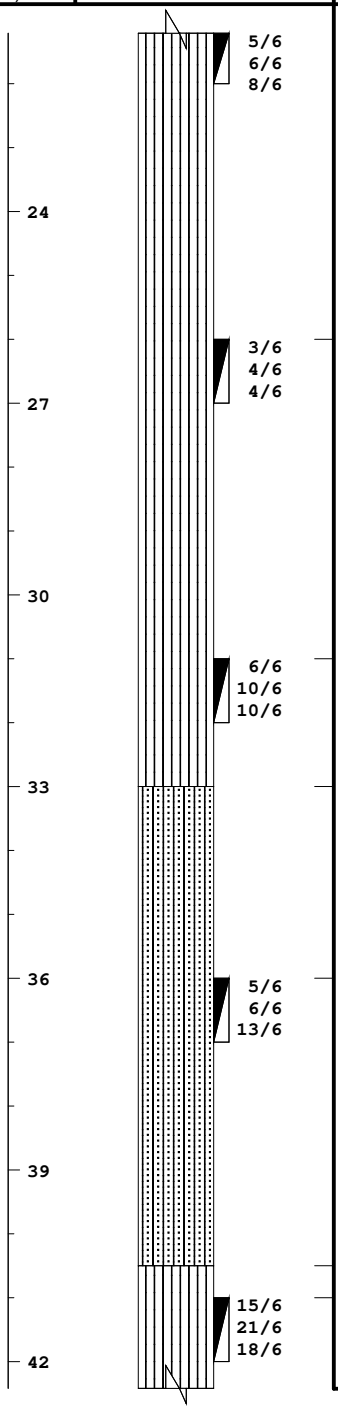


ELEVATION/ DEPTH (feet)	USCS	Description	Remarks	Density pcf	Moisture %
	GM	Approx. 2 inches concrete.			
	SM	No visible wire mesh. Approx. 3 inches aggregate base.			
	ML	SILTY SAND; dark brown, moist, fine, cohesive.			8.3
		SANDY SILT; dark brown, moist. Medium stiff.			
		Soft.			12.3
	SM	SILTY SAND; yellowish brown, damp to moist, fine grained.			
	ML	SANDY SILT; yellowish brown, moist, traces of clay.			
		Medium stiff.			11.3
					12.8

Figure Number 12

LOG OF TEST BORING
BORING B-11

PROJECT: *University Center & Student Union Buildings* **FILE NO:** *19596*
BORING DATE: *03/26/24* **ELEV.:**
BORING LOCATION: *See Boring Location Map, Figure 1* **START:** *03/26/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger* **FINISH:** *03/26/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▽ **:** *N/A* **CAVING -** ▰ **:** *N/A* **LOGGER:** *LW*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
			Stiff.			13.0
			Medium stiff.			13.1
			Stiff.			10.5
		SM	**SILTY SAND; light brown, damp, fine, cohesive.**			
			Medium dense.			8.6
		ML	**CLAYEY SILT; brown, moist, low plasticity**			
			Very stiff.			11.5

Figure Number 12

LOG OF TEST BORING
BORING B-11

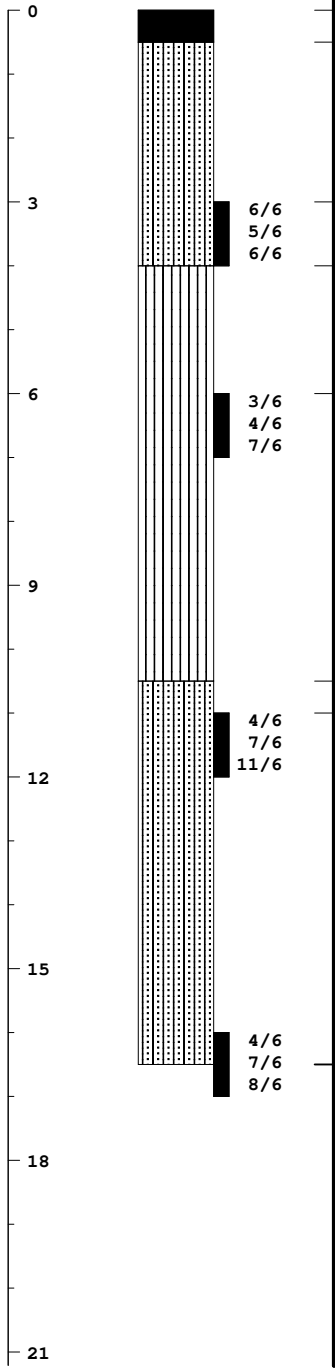
PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/26/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/26/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/26/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▽ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
45	8/6 11/6 11/6	CL	CLAY; yellowish brown, damp to moist, medium plasticity. Stiff.			16.3
48		SP	POORLY GRADED SAND; light brown, damp, fine to medium grained, traces of fine gravel.			
51	8/6 10/6 13/6		Medium dense.			2.6
			BOTTOM.			
54						
57						
60						
63						

Figure Number 12

LOG OF TEST BORING
BORING B-12

PROJECT: *University Center & Student Union Buildings*
FILE NO: *19596*
BORING DATE: *03/25/24*
ELEV.:
BORING LOCATION: *See Boring Location Map, Figure 1*
START: *03/25/24*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *03/25/24*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*
LOGGER: *LW*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SM	Approx. 6 inches of concrete with 1/8 inch wire mesh. SILTY SAND; dark brown, moist, cohesive.			
	6/6 5/6 6/6		Loose.		110.7	5.3
		ML	SANDY SILT; dark brown, moist.			
	3/6 4/6 7/6		Medium stiff.		116.0	11.8
		SM	SILTY SAND; light yellowish brown, moist, fine, cohesive.		119.0	7.5
	4/6 7/6 11/6		Medium dense.			
	4/6 7/6 8/6		BOTTOM.		102.0	5.0

Figure Number 13

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Paving
	Silty gravel
	Silty sand
	Silt
	Clayey sand
	Low plasticity clay
	Poorly graded sand
Misc. Symbols	
	Boring continues
Soil Samplers	
	California sampler
	Standard penetration test

Notes:

1. Eleven (11) exploratory borings were drilled between 03/20/2024 and 03/26/2024 using an 8-inch outside diameter hollow-stem auger.

2. No free groundwater was encountered to the maximum depth drilled of 16.5'.

3. Boring locations are shown on the Boring Location Map, Figure 1.

4. These logs are subject to the limitations, conclusions, and recommendations in this report.

5. Results of tests conducted on samples recovered are reported on the logs.

College of the Sequoias

Geotechnical Engineering Services
615 S. Mooney Blvd, Visalia, CA 93277
University Center & Student Union Buildings

SEI File No. 24-19596
May 8, 2024

TABLE 1

TEST LOCATION	USCS	% < # 200	CONSOLIDATION				DIRECT SHEAR		UNCONFINED COMPRESSION		E.I.	MINIMUM RESISITIVITY	ATTERBERG LIMITS			R-VALUE @ 300 psi		MAXIMUM DENSITY	
			C_C	C_S	S.P. (psf)	HV %	C, (ksf)	F.A.	Q_U, (psi)	C, (ksf)			LL	PL	PI	R.V.	E.P. (psi)	MDD (pcf)	O.M.
B-6 @ 3'	SM						0.22	32.6											
B-6 @ 6'	SM		0.04	0.01	0	-0.2													
B-6 @ 11'	SM						0.49	35.9											
B-7 @ 3'	SM						0.59	45											
B-7 @ 6'	ML		0.18	0.02	0	-0.3													
B-7 @ 11'	SM						0.15	44											
B-10 @ 0-5'	SM	33									0								
B-10 @ 3'	SM						0.46	37											
B-10 @ 6'	ML		0.02	0.01	0	-0.2													
R-1 @ 0-5'	SP-SM	9.4														67	0		
R-2 @ 0-5'	SC	42														28	0.14		

CONSOLIDATION
Cc - Compression Index
Cs - Swell Index
S.P. (psf) - Swell Pressure
HV % - Heave Percentage / Collapse

UNCONFINED COMPRESSION
Q_U (psi) - Unconfined Compression Strength
C, (ksf) - Cohesion

DIRECT SHEAR
C (ksf) - Cohesion
F.A. - Friction Angle

E.I. - EXPANSION INDEX

ATTERBERG LIMITS
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index

RESISTANCE VALUE (R-VALUE)
RV - R-Value @ 300 psi
EP - Expansion Press @ 300 psi

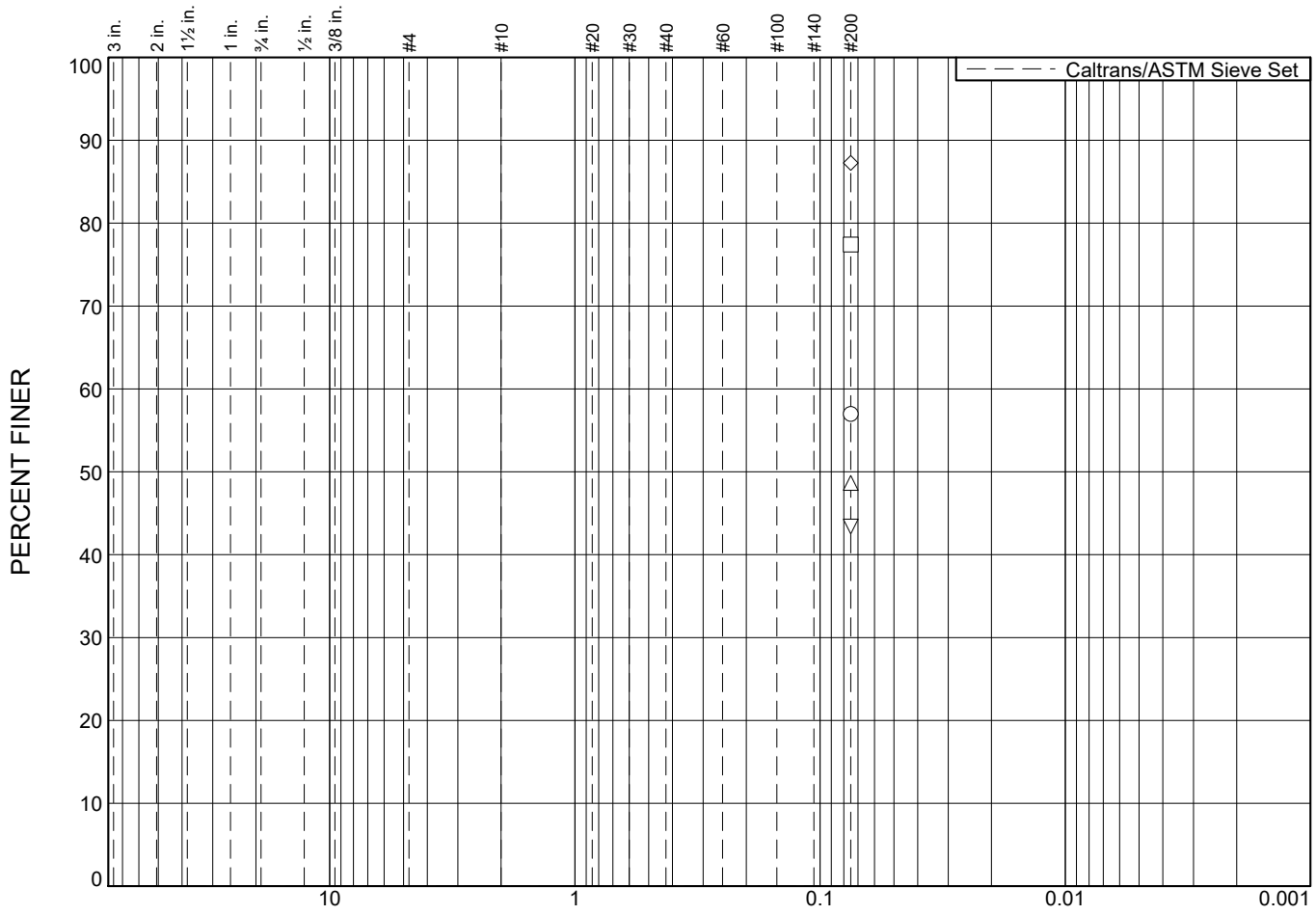
MINIMUM RESISITIVITY - (ohm-cm)

MAXIMUM DENSITY
MDD (pcf) - Max Dry Density
O.M. - Optimum Moisture

SOILS ENGINEERING, INC.

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Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							57	
□							77	
△							49	
◇							87	
▽							43	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-3		11'	SANDY SILT	ML
□	B-3		16'	SANDY SILT	ML
△	B-3		21'	CLAYEY SAND	SC
◇	B-3		26'	SANDY CLAY	CL
▽	B-3		31'	SILTY SAND	SM

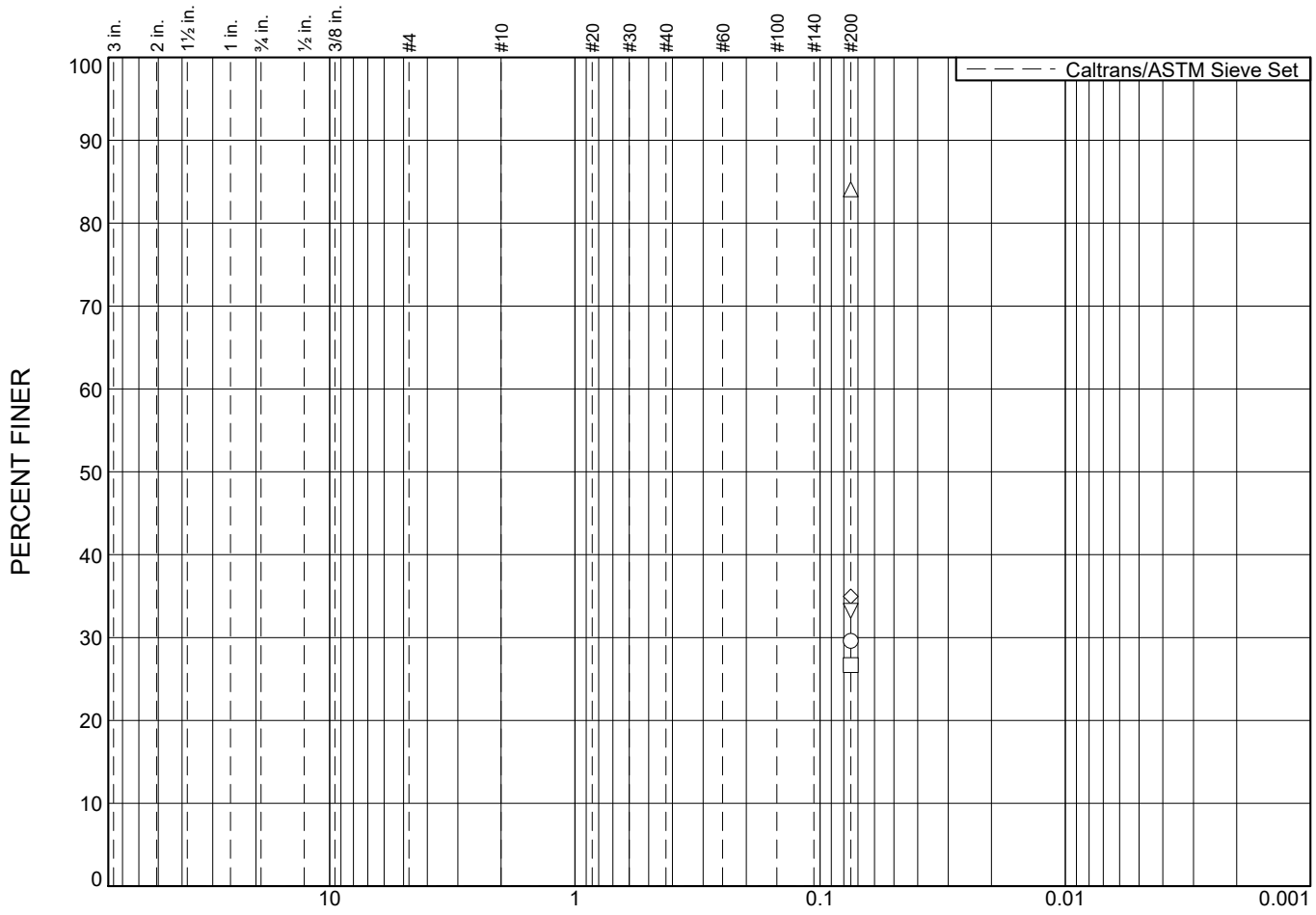
SOILS ENGINEERING, INC.

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Project No.: 19596 **Figure** A-1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							30	
□							27	
△							84	
◇							35	
▽							33	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-3		36'	POORLY GRADED SAND	SP
□	B-3		41'	SILTY SAND	SM
△	B-3		46'	SANDY SILT	ML
◇			0-5'	SILTY SAND (B-6)	SM
▽			0-5'	SILTY SAND (B-10)	SM

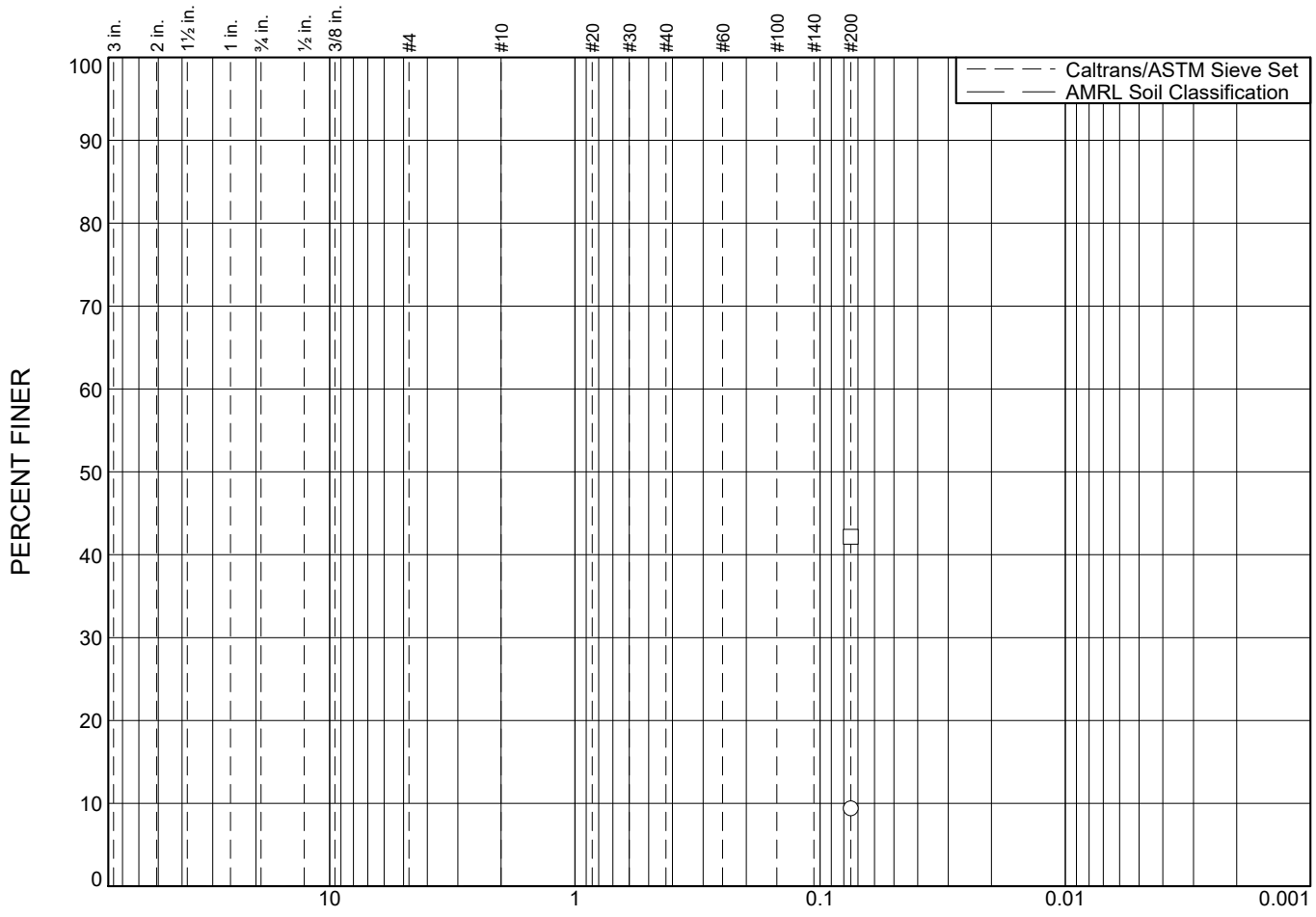
SOILS ENGINEERING, INC.

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Project No.: 19596 **Figure** A-2

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							9.4	
□							42.2	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		94019	0-5'	POORLY GRADED SAND with silt (R-1 @ 0-5')	SP-SM
□		94020	0-5'	CLAYEY SAND (R-2 @ 0-5')	SC

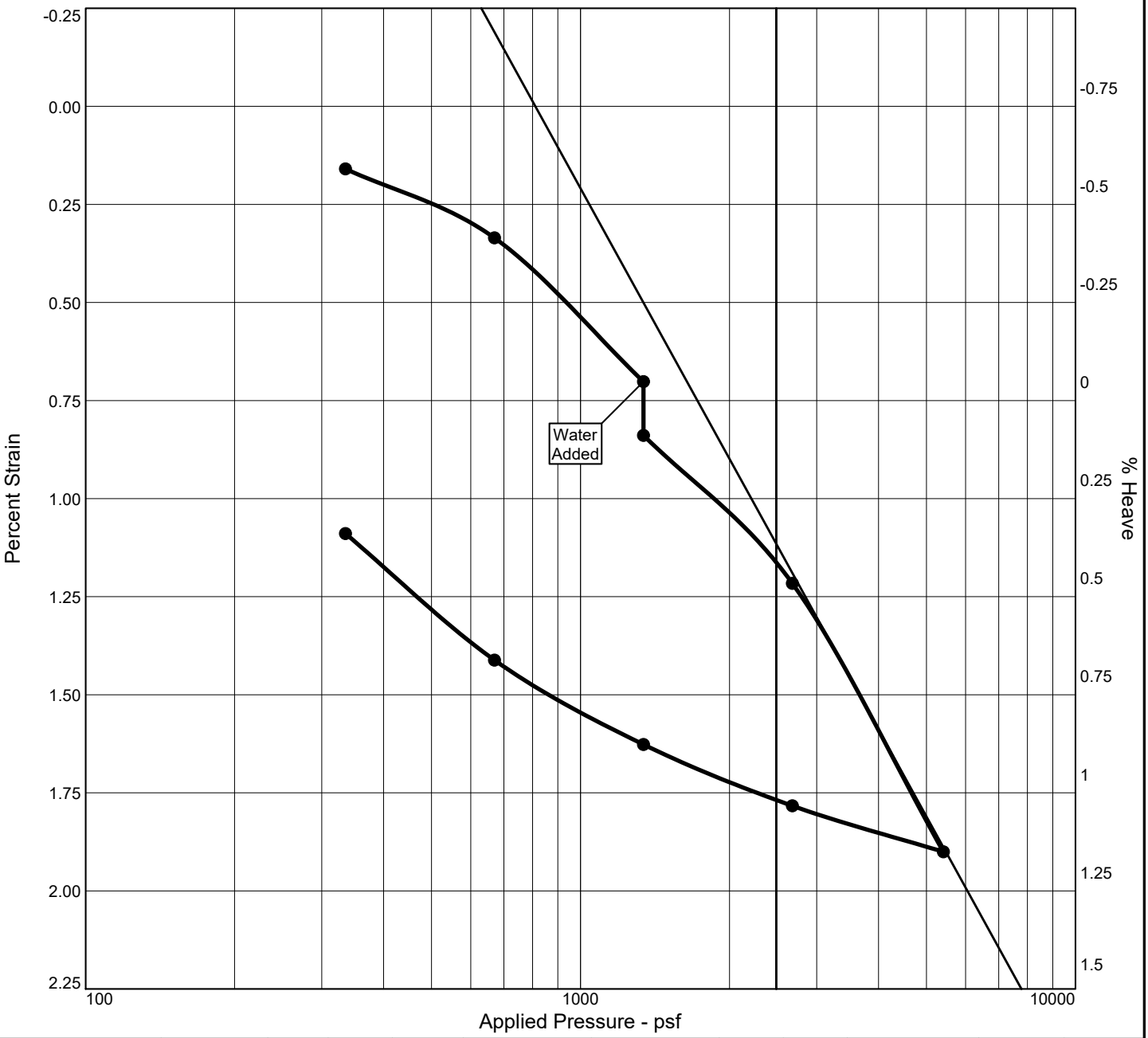
SOILS ENGINEERING, INC.

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Project No.: 19596 **Figure** A-3

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
78.6 %	17.7 %	103.5	N/A	N/A	2.65	336	2671	0.04	0.01		-0.1	0.598

MATERIAL DESCRIPTION	USCS	AASHTO
CLAYEY SAND	SC	

Project No. 19596 **Client:** College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-2 **Depth:** 6'

Remarks:

Test Date: 04/11/24

Sample No.: 93964

SOILS ENGINEERING, INC.

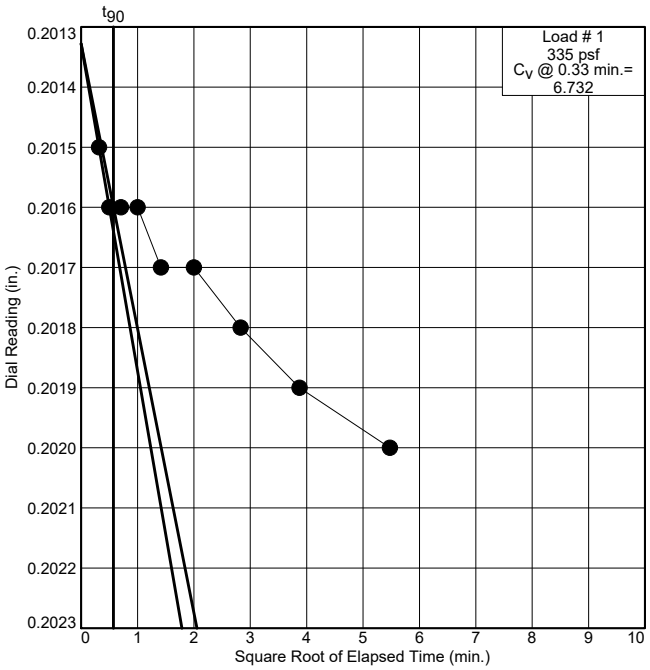
Figure B-1

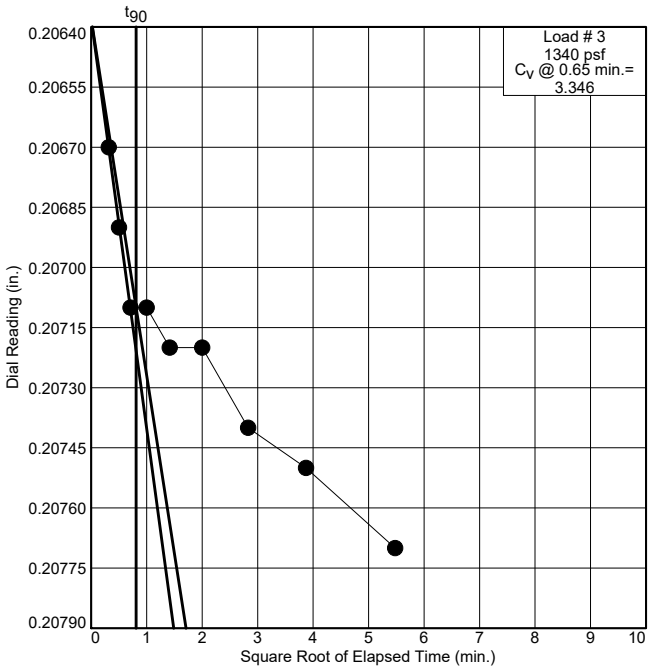
Tested By: RG **Checked By:** AL

Dial Reading vs. Time

Project No.: 19596
Project: University Center & Student Union Buildings

Source of Sample: B-2 Depth: 6'

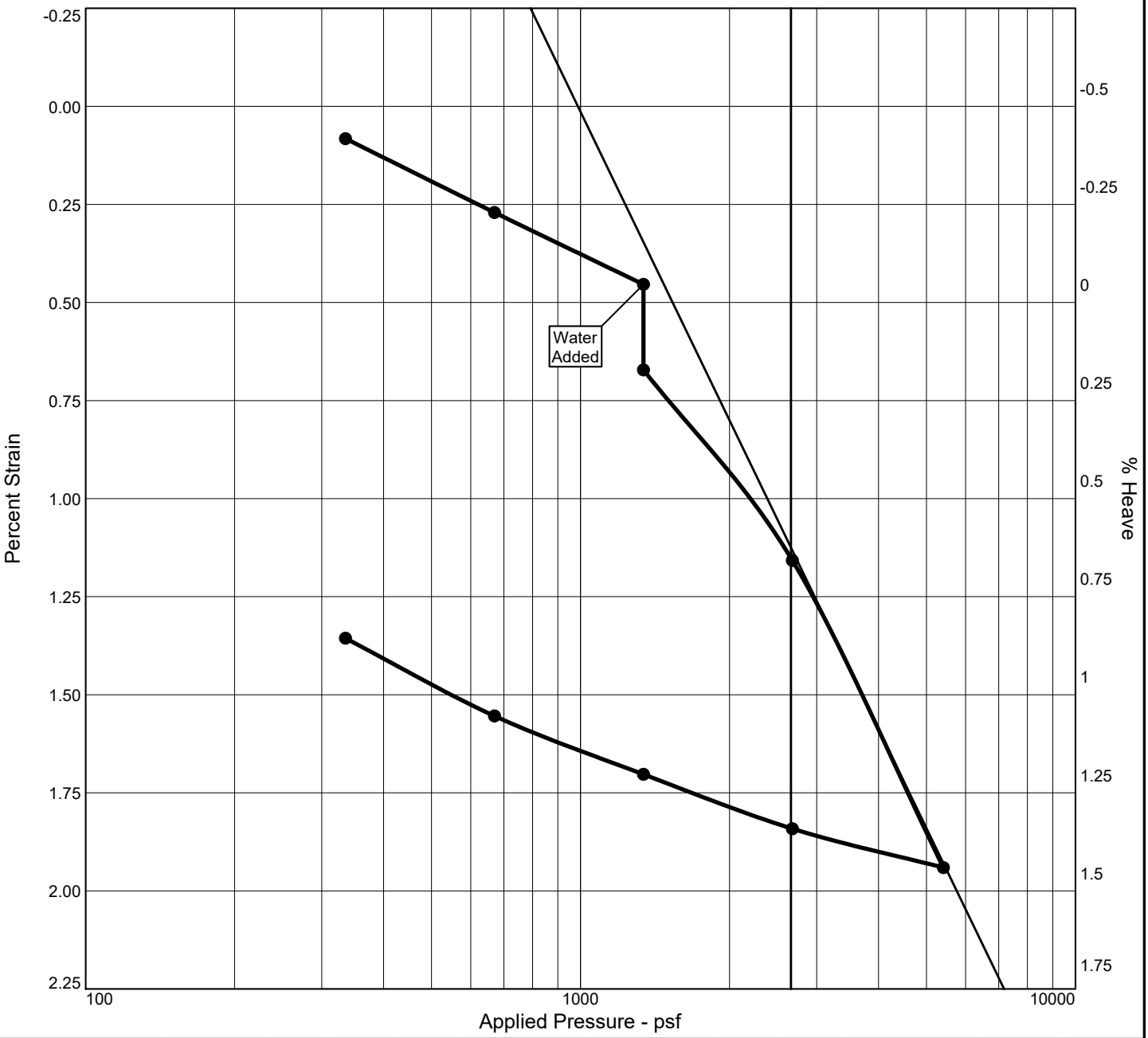




SOILS ENGINEERING, INC.

Figure B-1

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
57.2 %	12.2 %	105.7	N/A	N/A	2.65	336	2768	0.04	0.01		-0.2	0.564

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND	SM	

Project No. 19596 **Client:** College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-6 **Depth:** 6'

Remarks:

Test Date: 04/11/24

Sample No.: 93988

SOILS ENGINEERING, INC.

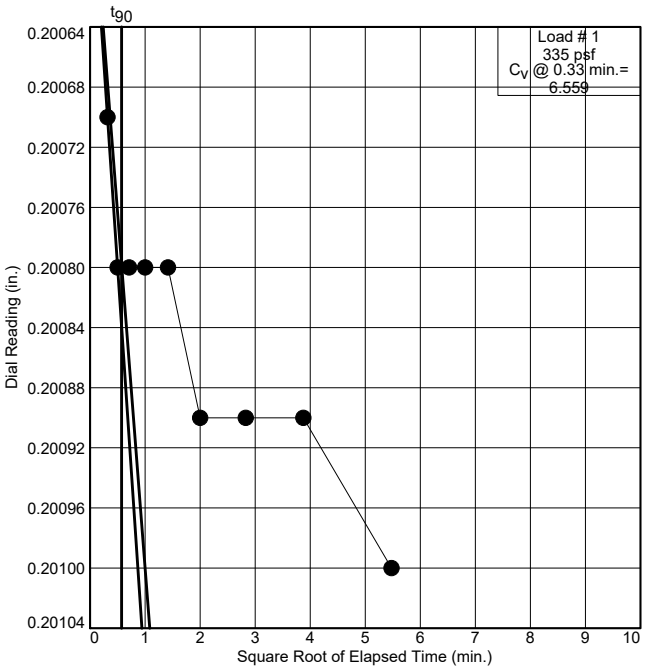
Figure B-2

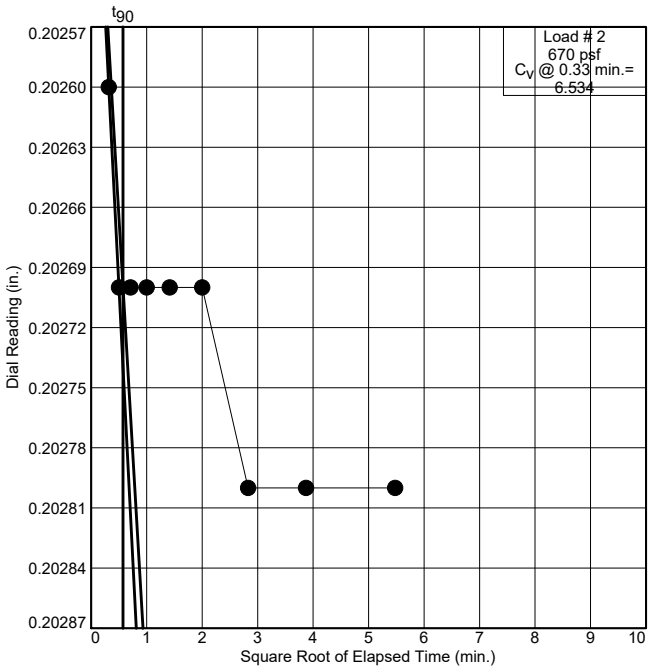
Tested By: RG **Checked By:** AL

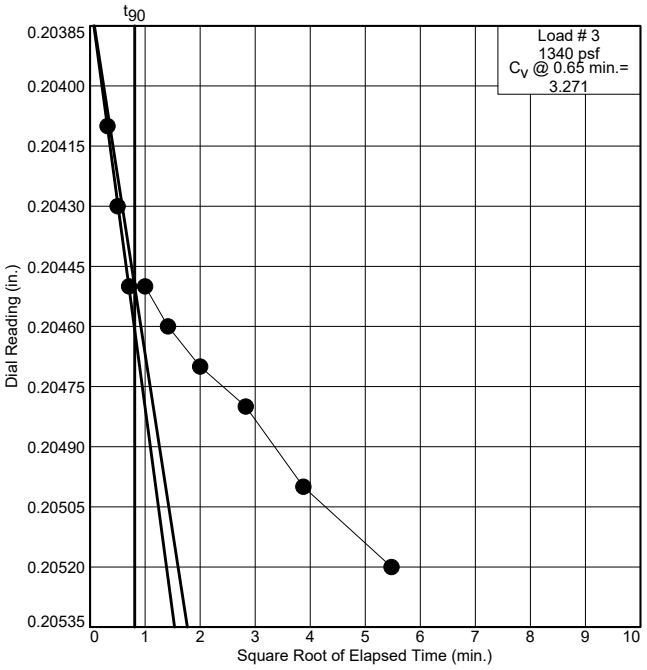
Dial Reading vs. Time

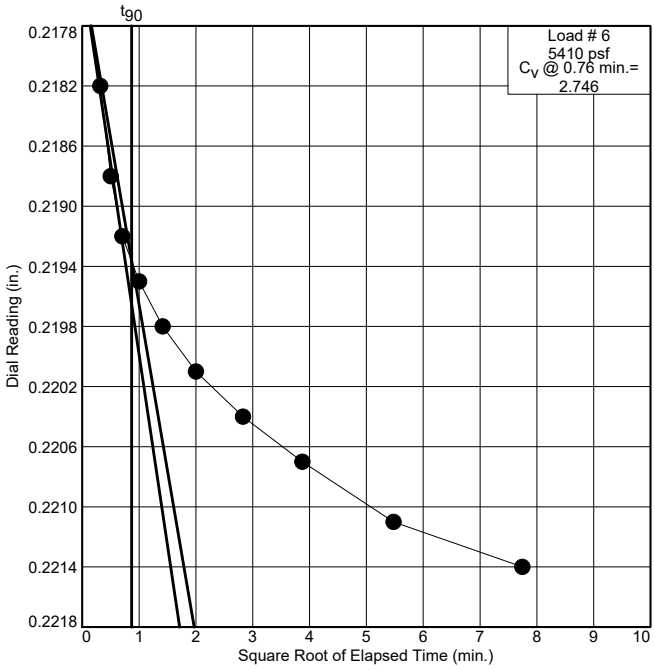
Project No.: 19596
Project: University Center & Student Union Buildings

Source of Sample: B-6 Depth: 6'





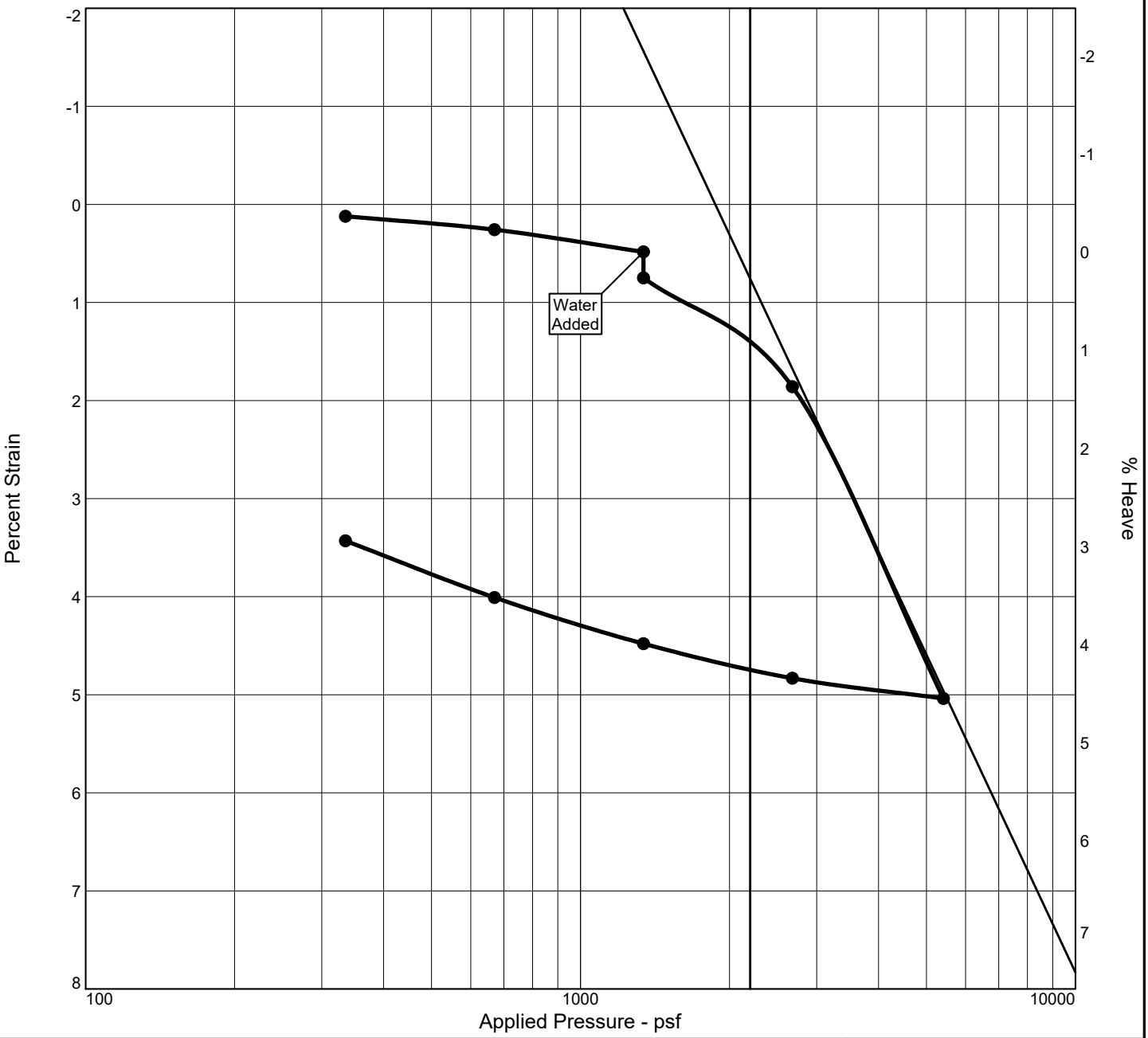




SOILS ENGINEERING, INC.

Figure B-2

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
42.5 %	11.3 %	97.2	N/A	N/A	2.65	336	2599	0.18	0.02		-0.3	0.702

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY SILT	ML	

Project No. 19596 **Client:** College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-7 **Depth:** 6'

Remarks:

Test Date: 04/11/24

Sample No.: 93992

SOILS ENGINEERING, INC.

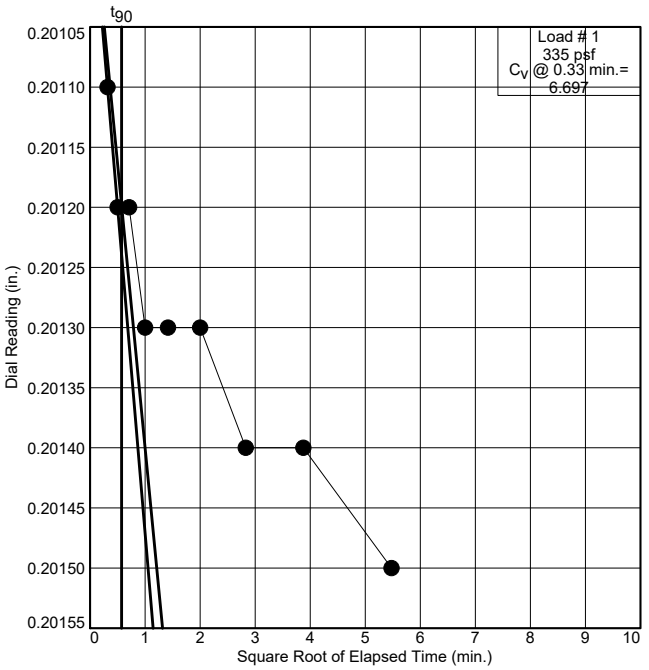
Figure B-3

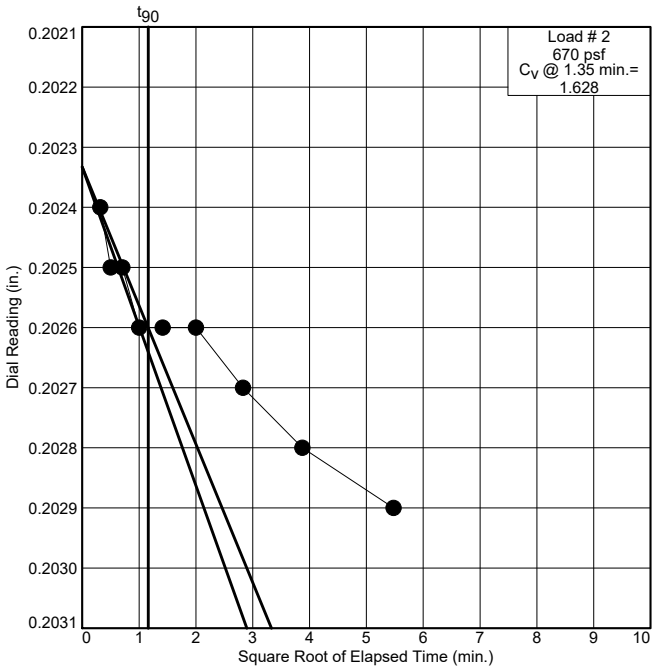
Tested By: RG **Checked By:** AL

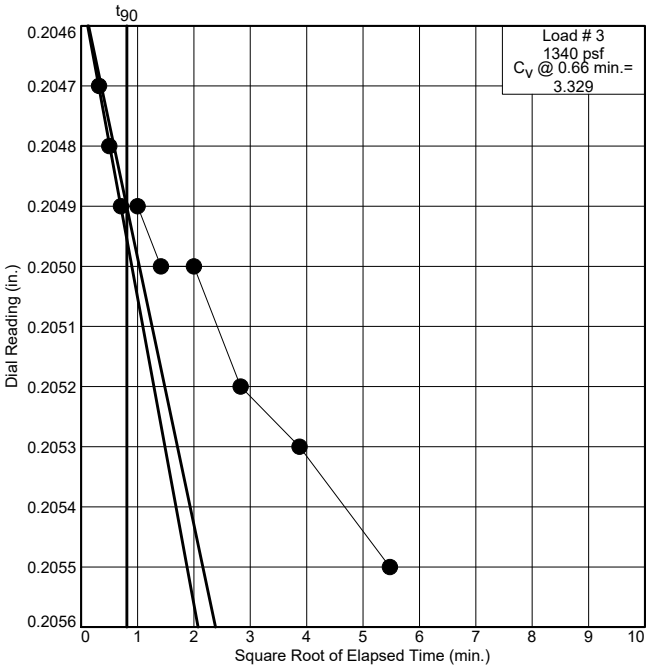
Dial Reading vs. Time

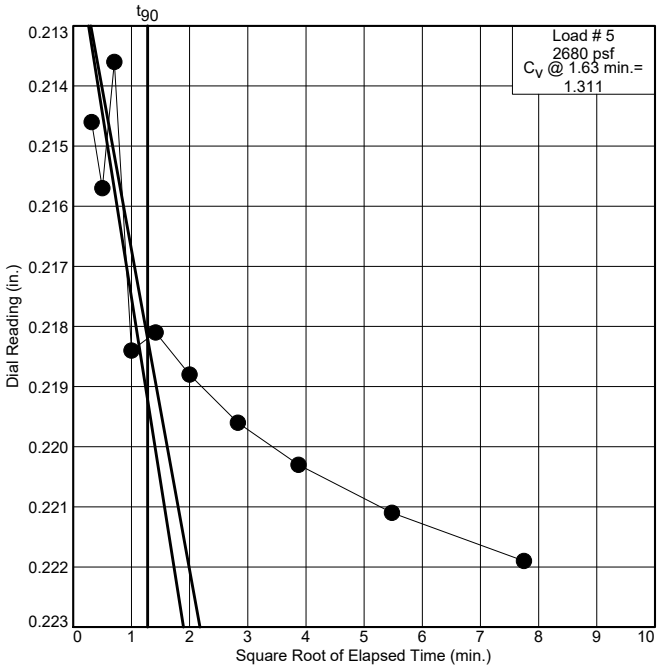
Project No.: 19596
Project: University Center & Student Union Buildings

Source of Sample: B-7 Depth: 6'









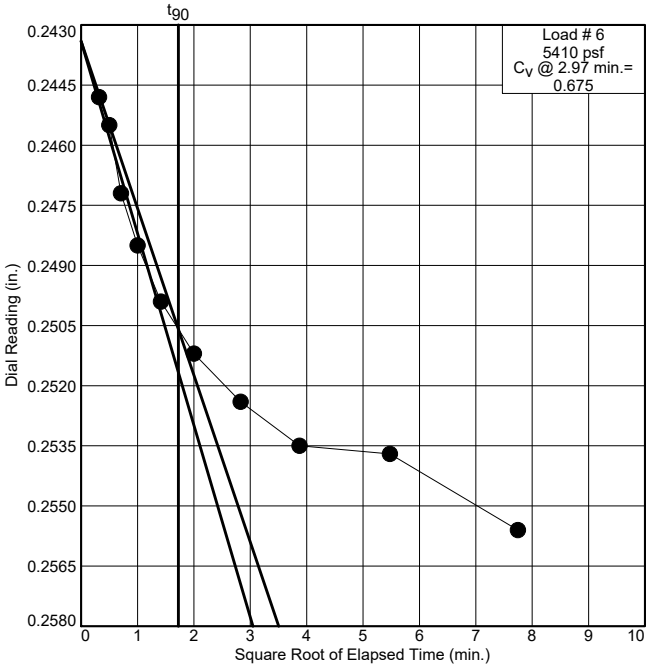
SOILS ENGINEERING, INC.

Figure B-3

Dial Reading vs. Time

Project No.: 19596
Project: University Center & Student Union Buildings

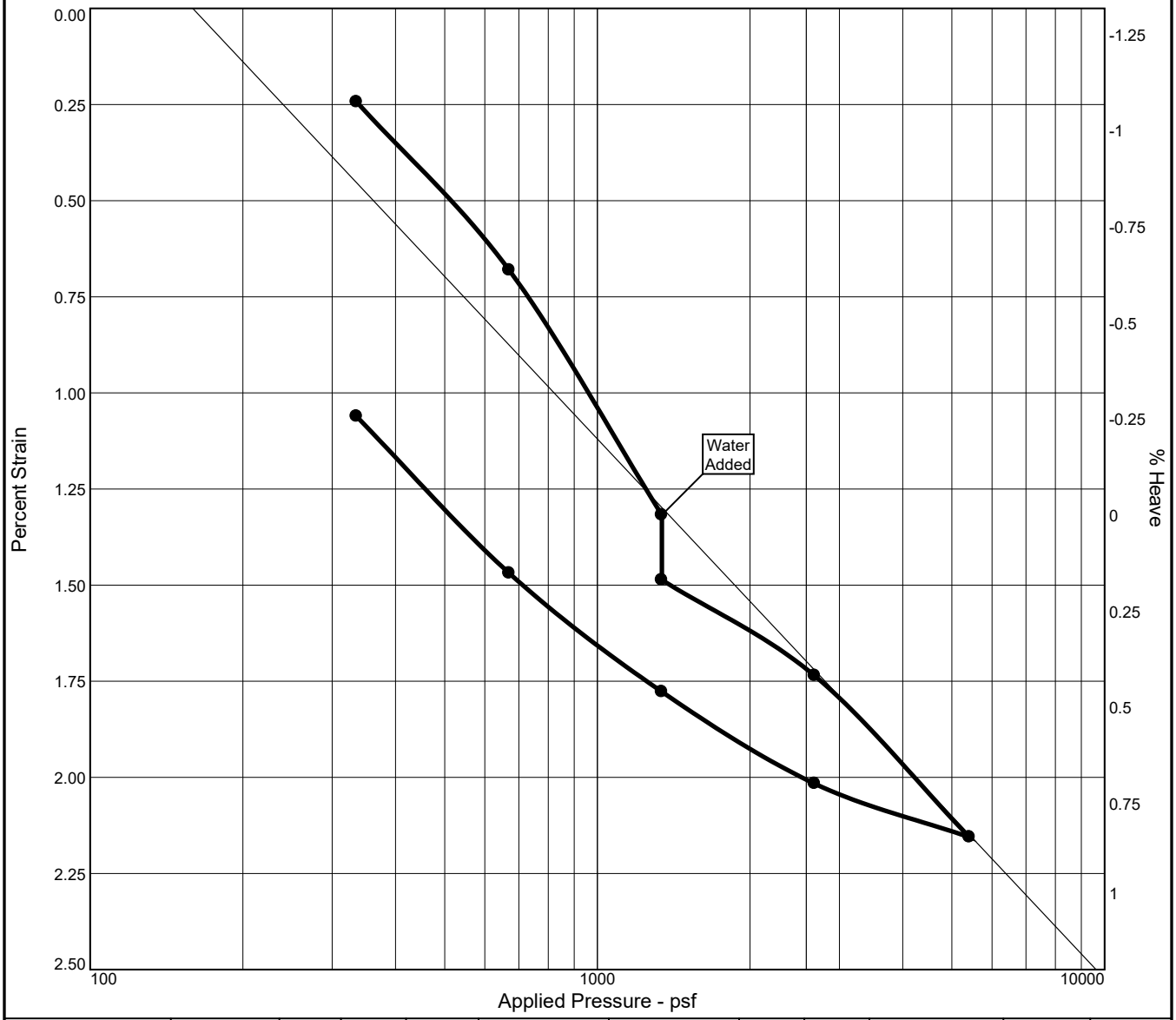
Source of Sample: B-7 Depth: 6'



SOILS ENGINEERING, INC.

Figure B-3

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
79.9 %	16.8 %	106.3	N/A	N/A	2.65	336	2720	0.02	0.01		-0.2	0.556

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY SILT	ML	N/A

Project No. 19596 **Client:** College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-10 **Depth:** 6'

Remarks:
Test Date: 04/11/24
Sample No.: 94000

SOILS ENGINEERING, INC.

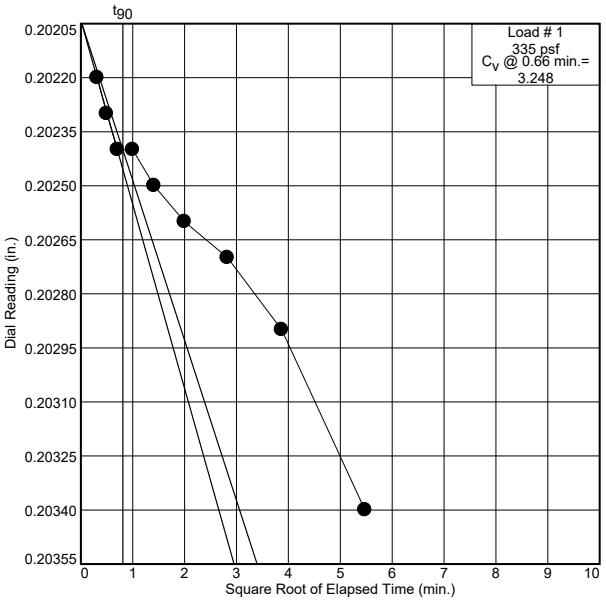
Figure B-4

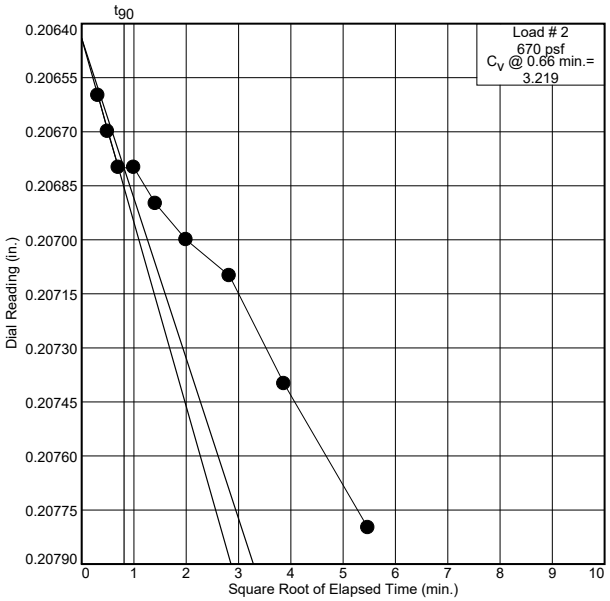
Tested By: RG **Checked By:** AL

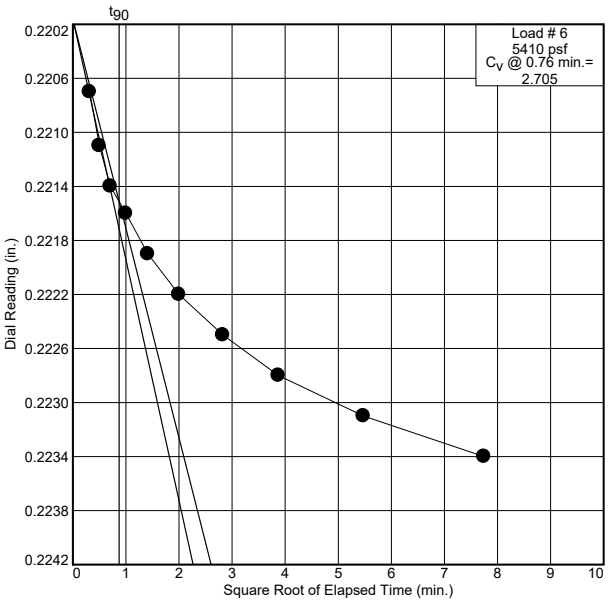
Dial Reading vs. Time

Project No.: 19596
Project: University Center & Student Union Buildings

Source of Sample: B-10 Depth: 6'

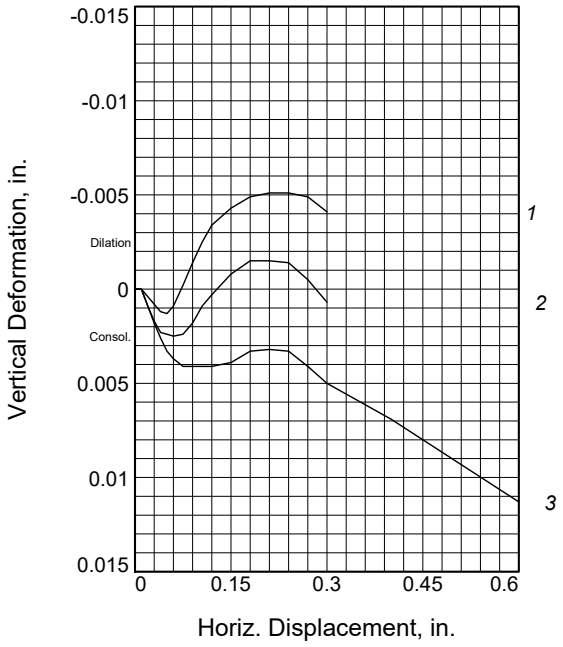


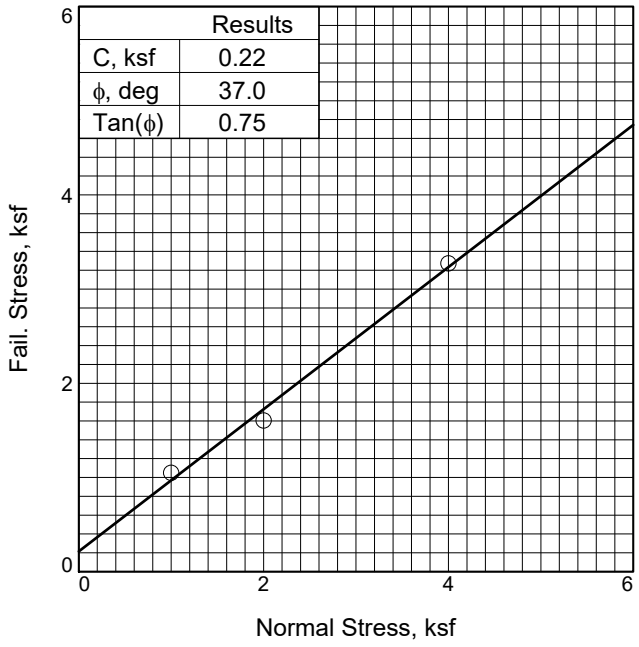


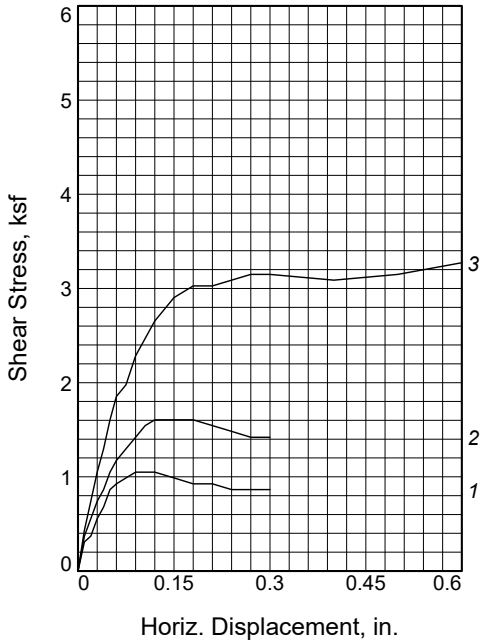


SOILS ENGINEERING, INC.

Figure B-4







Sample No.		1	2	3
Initial	Water Content, %	16.6	16.2	16.2
	Dry Density, pcf	99.1	104.3	105.3
	Saturation, %	65.7	73.4	75.0
	Void Ratio	0.6685	0.5860	0.5717
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	20.4	20.9	17.6
	Dry Density, pcf	99.1	104.3	105.3
	Saturation, %	80.8	94.3	81.8
	Void Ratio	0.6685	0.5860	0.5717
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		1.05	1.61	3.27
Displacement, in.		0.09	0.12	0.60
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE

Description: SILTY SAND; dark yellowish brown, damp, cohesive.

LL= N/A **PI=** N/A

Assumed Specific Gravity= 2.65

Remarks: Test Date: 04/24/24

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-2 **Depth:** 3'

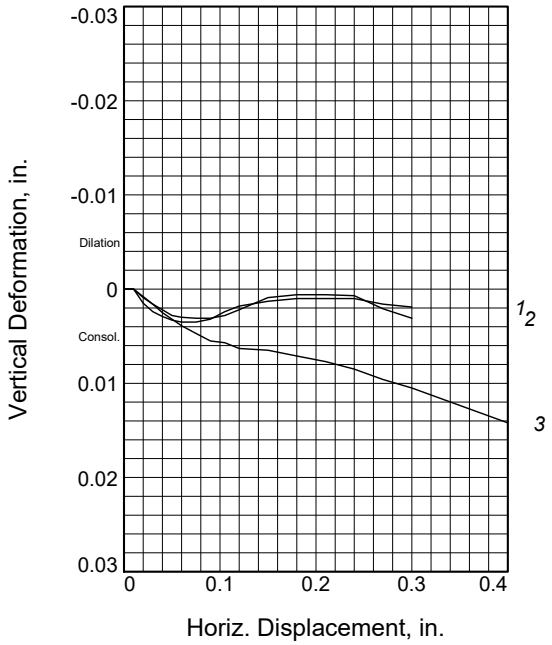
Proj. No.: 19596 **Date Sampled:** 03/20/24

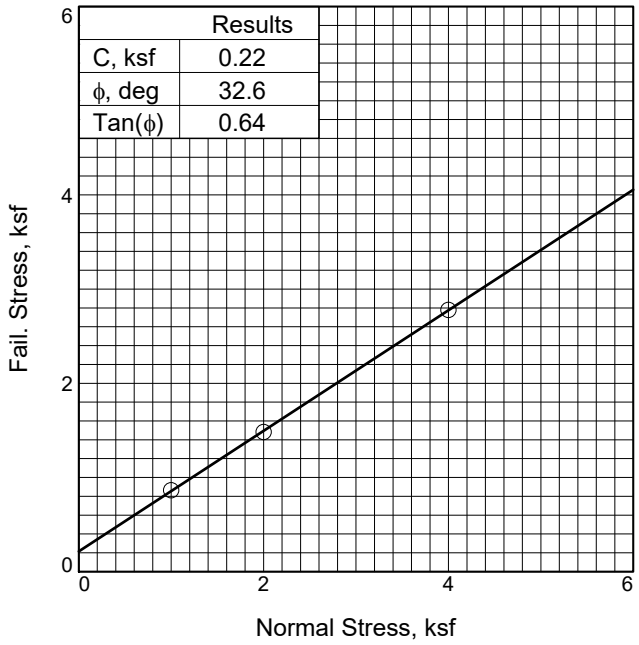
DIRECT SHEAR TEST REPORT

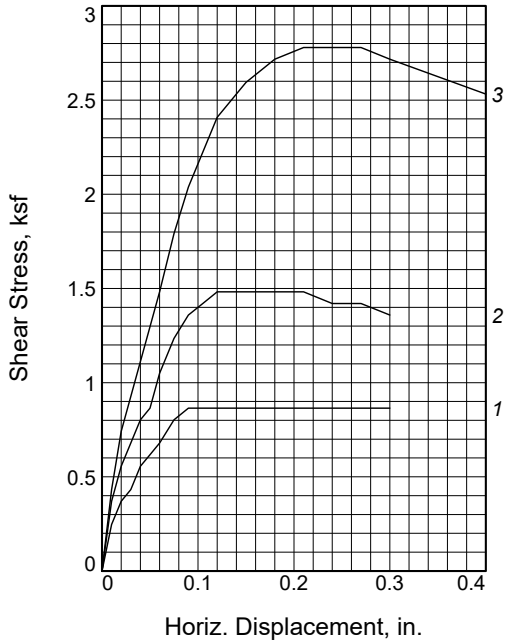
SOILS ENGINEERING, INC.

Figure C-1

Tested By: SC **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	17.9	22.1	20.4
	Dry Density, pcf	93.7	93.4	95.0
	Saturation, %	62.0	75.9	72.8
	Void Ratio	0.7650	0.7715	0.7410
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	25.3	25.2	21.4
	Dry Density, pcf	93.7	93.4	95.0
	Saturation, %	87.7	86.7	76.4
	Void Ratio	0.7650	0.7715	0.7410
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		0.86	1.48	2.78
Displacement, in.		0.09	0.12	0.21
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE
Description: SILTY SAND; dark brown, damp, cohesive, traces of organics.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 04/24/24

Figure C-2

Client: College of the Sequoias

Project: University Center & Student Union Buildings

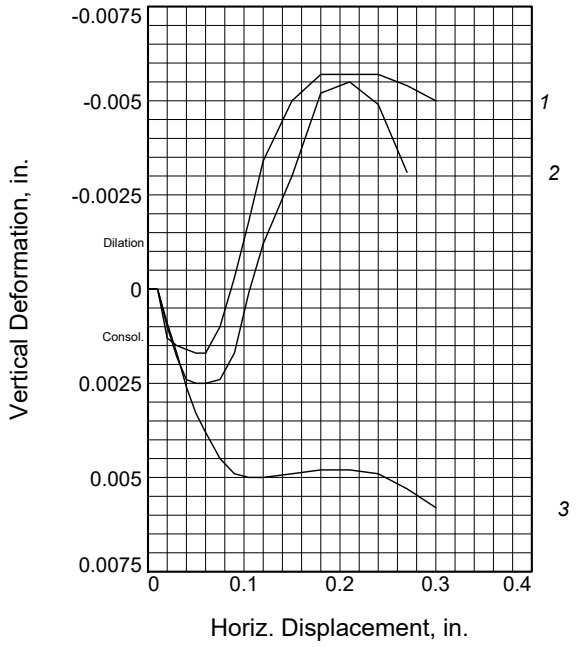
Source of Sample: B-6 **Depth:** 3'

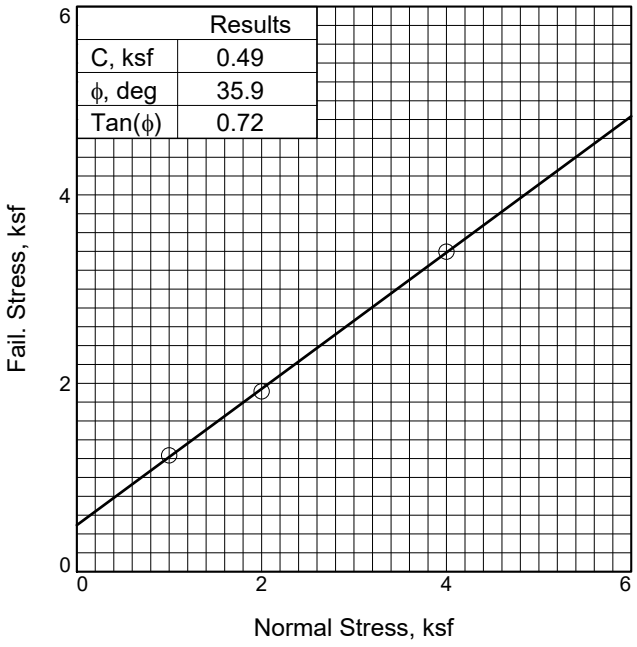
Proj. No.: 19596 **Date Sampled:** 03/25/24

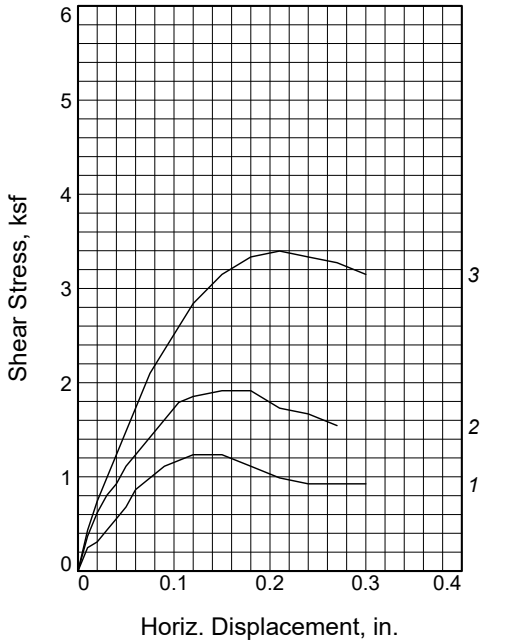
DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: SC **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	16.7	17.8	18.3
	Dry Density, pcf	109.9	111.2	110.2
	Saturation, %	87.4	96.6	96.5
	Void Ratio	0.5053	0.4879	0.5018
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	18.6	18.3	17.9
	Dry Density, pcf	109.9	111.2	110.2
	Saturation, %	97.7	99.1	94.4
	Void Ratio	0.5053	0.4879	0.5018
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		1.24	1.91	3.40
Displacement, in.		0.12	0.15	0.21
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE
Description: SILTY SAND; dark brown, damp, cohesive.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 04/24/24

Figure C-3

Client: College of the Sequoias

Project: University Center & Student Union Buildings

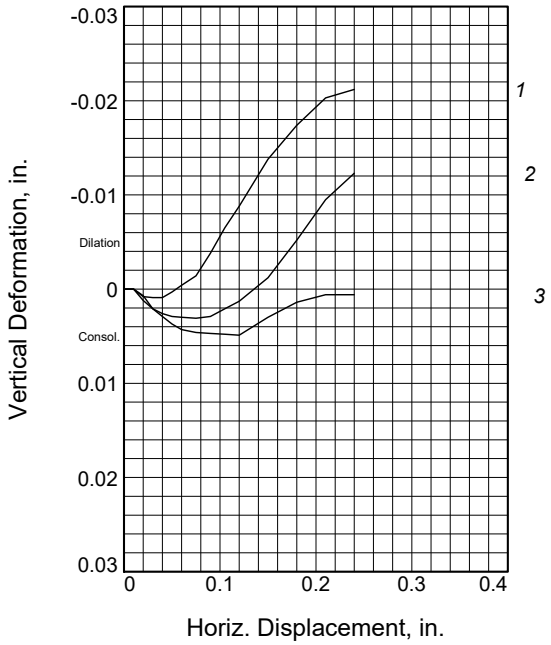
Source of Sample: B-6 **Depth:** 11'

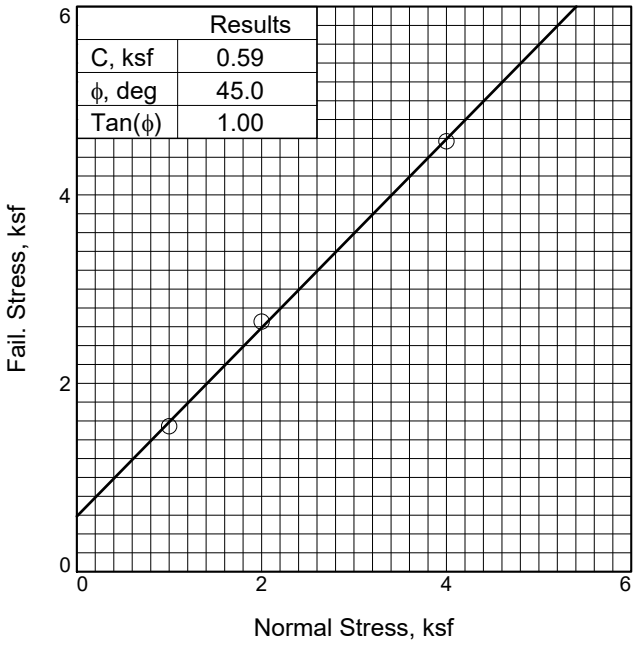
Proj. No.: 19596 **Date Sampled:** 03/25/24

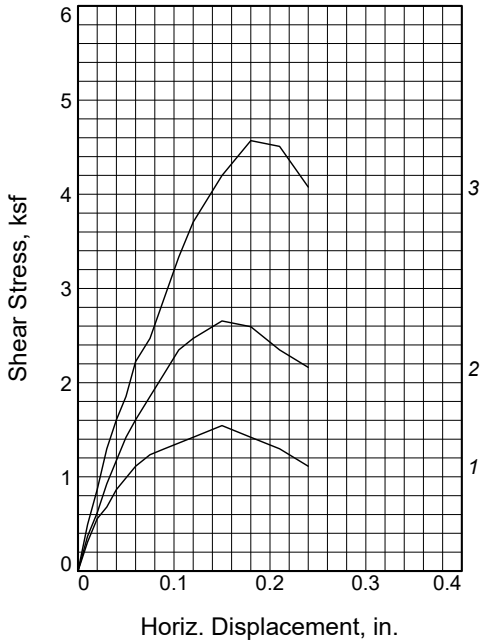
DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: SC **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	19.6	19.0	17.5
	Dry Density, pcf	92.5	98.5	101.5
	Saturation, %	66.0	74.2	73.4
	Void Ratio	0.7879	0.6802	0.6304
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	26.5	22.6	18.8
	Dry Density, pcf	92.5	98.5	101.5
	Saturation, %	89.1	88.1	79.1
	Void Ratio	0.7879	0.6802	0.6304
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		1.54	2.66	4.57
Displacement, in.		0.15	0.15	0.18
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE
Description: SILTY SAND; dark brown, damp, with low plasticity clay.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 04/24/24

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-7 **Depth:** 3'

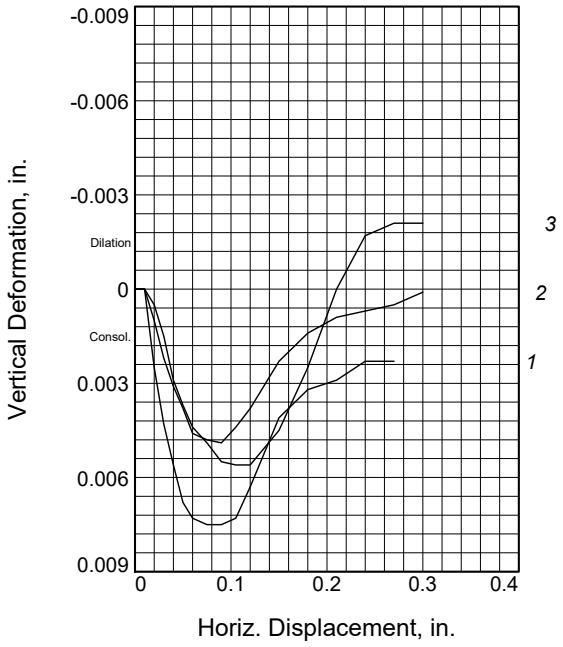
Proj. No.: 19596 **Date Sampled:** 03/25/24

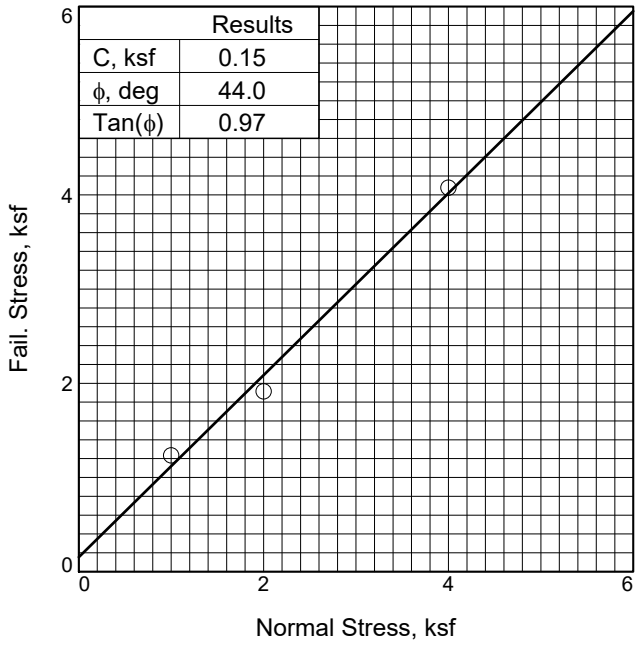
DIRECT SHEAR TEST REPORT

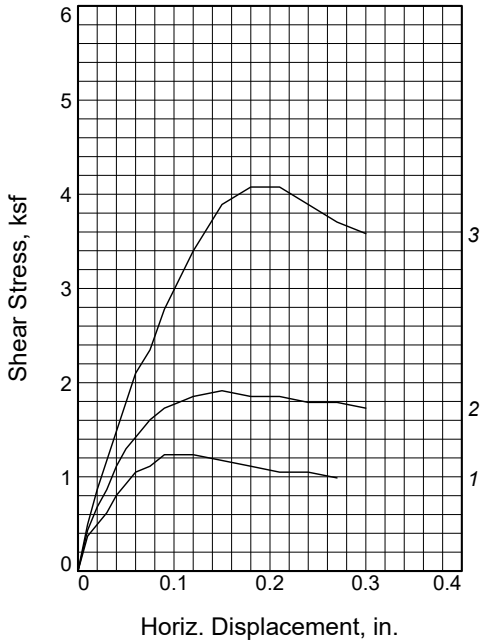
SOILS ENGINEERING, INC.

Figure C-4

Tested By: SC **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	6.2	6.3	5.4
	Dry Density, pcf	104.8	108.7	110.7
	Saturation, %	28.2	32.1	29.1
	Void Ratio	0.5782	0.5220	0.4948
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	18.6	17.1	15.4
	Dry Density, pcf	104.8	108.7	110.7
	Saturation, %	85.3	86.8	82.4
	Void Ratio	0.5782	0.5220	0.4948
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		1.24	1.91	4.08
Displacement, in.		0.09	0.15	0.18
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE
Description: SILTY SAND; dark yellowish brown, dry, cohesive.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 04/26/24

Figure C-5

Client: College of the Sequoias

Project: University Center & Student Union Buildings

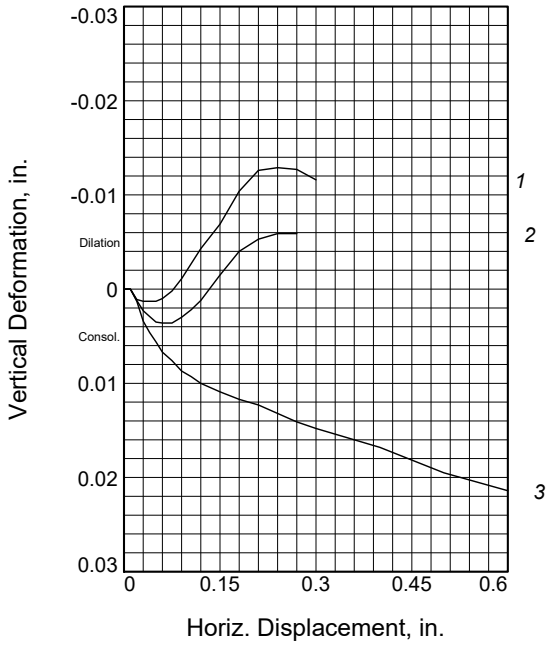
Source of Sample: B-7 **Depth:** 11'

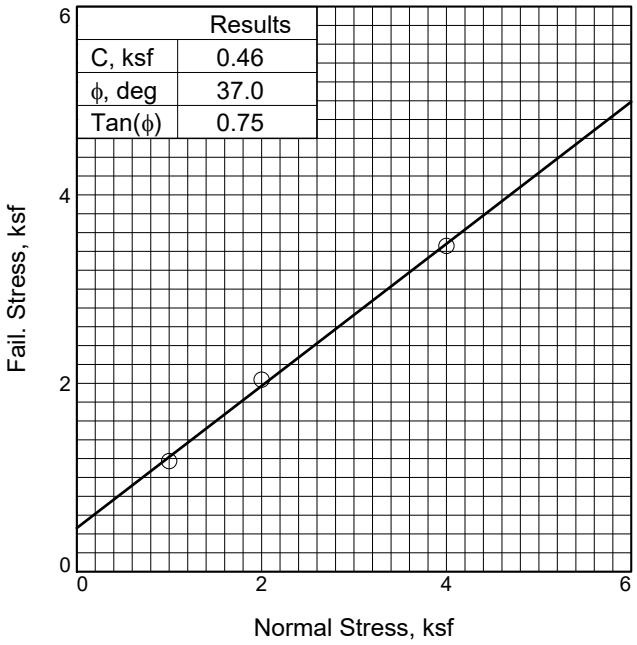
Proj. No.: 19596 **Date Sampled:** 03/25/24

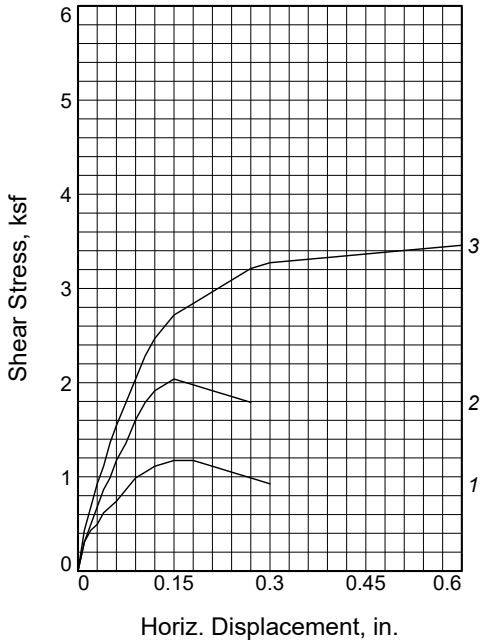
DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: SC **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	16.1	11.5	11.6
	Dry Density, pcf	107.2	111.4	109.9
	Saturation, %	78.7	62.8	60.7
	Void Ratio	0.5428	0.4856	0.5053
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	19.0	15.8	16.7
	Dry Density, pcf	107.2	111.4	109.9
	Saturation, %	92.8	86.0	87.4
	Void Ratio	0.5428	0.4856	0.5053
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		1.17	2.04	3.46
Displacement, in.		0.15	0.15	0.60
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" x 6" TUBE
Description: SILTY SAND; dark brown, damp, cohesive.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 04/25/24

Figure C-6

Client: College of the Sequoias

Project: University Center & Student Union Buildings

Source of Sample: B-10 **Depth:** 3'

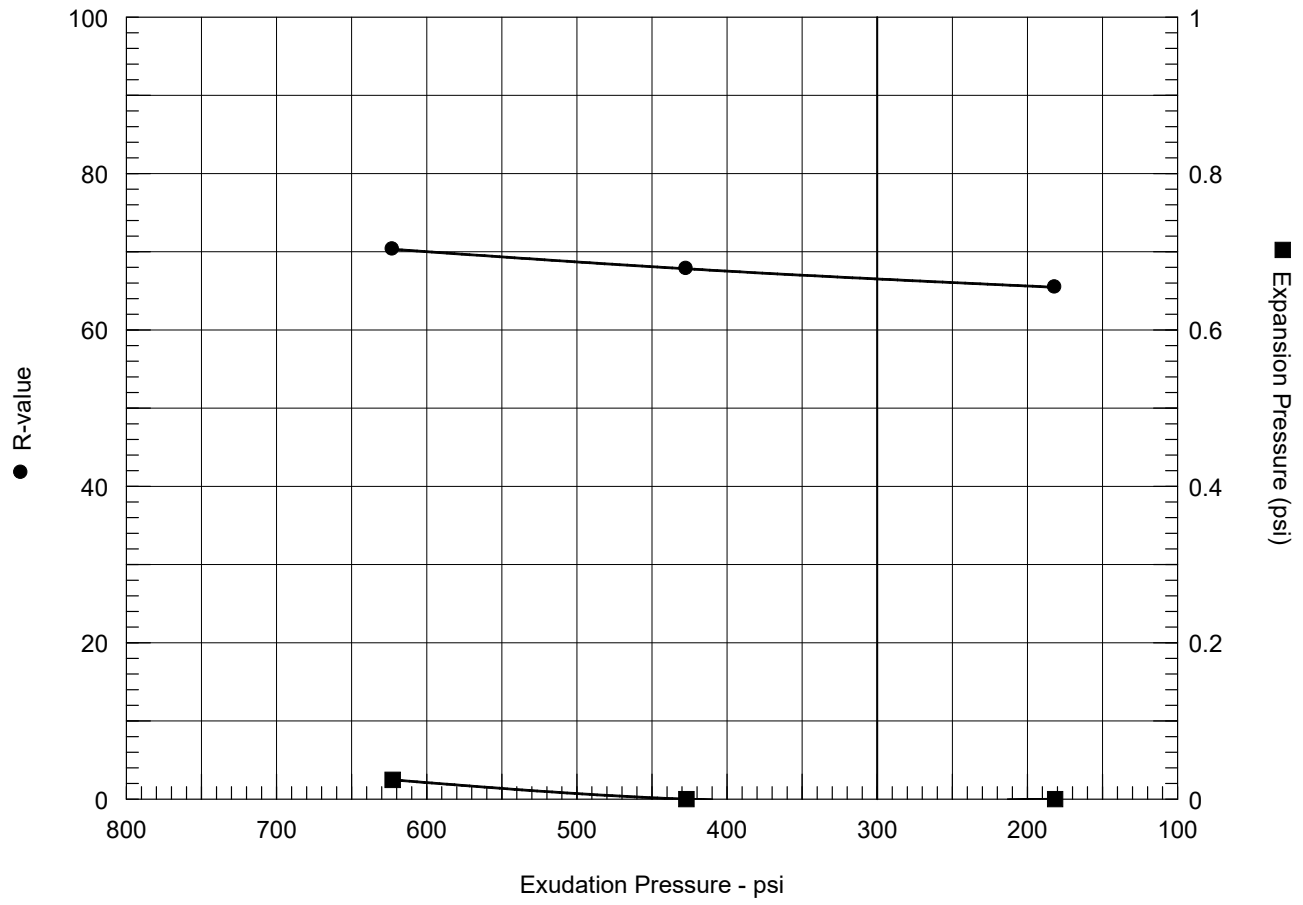
Proj. No.: 19596 **Date Sampled:** 03/26/24

DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: SC **Checked By:** AL

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	116.0	10.2	0.02	27	2.48	623	70	70
2	350	110.3	11.2	0.00	30	2.55	427	68	68
3	350	116.3	12.2	0.00	31	2.45	182	65	65

Test Results	Material Description
R-value at 300 psi exudation pressure = 67 **Exp. pressure at 300 psi exudation pressure =** 0.00 psi	POORLY GRADED SAND with silt (R-1 @ 0-5')

Project No.: 19596
Project: University Center & Student Union Buildings
Location: R-1
Sample Number: 94019 **Depth:** 0-5'
Date: 5/8/2024

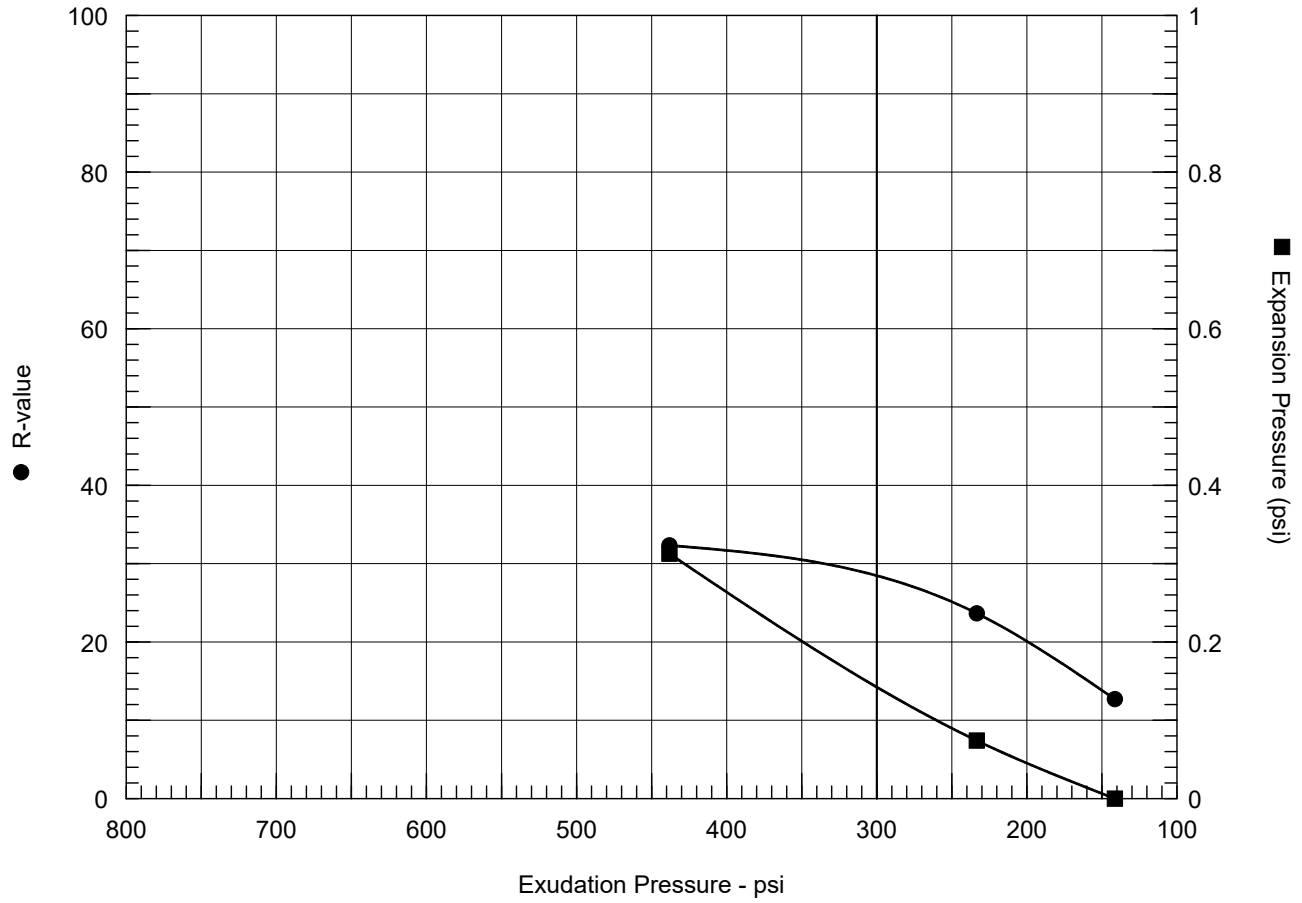
Tested by: RC
Checked by: AL
Remarks:
Test Date: 04/12/24

R-VALUE TEST REPORT

SOILS ENGINEERING, INC.

Figure D-1

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	129.5	11.7	0.31	80	2.35	438	36	32
2	125	126.2	12.8	0.07	100	2.41	233	25	24
3	60	120.1	13.9	0.00	122	2.52	141	13	13

Test Results	Material Description
R-value at 300 psi exudation pressure = 28 **Exp. pressure at 300 psi exudation pressure =** 0.14 psi	CLAYEY SAND (R-2 @ 0-5')

Project No.: 19596
Project: University Center & Student Union Buildings
Location: R-2
Sample Number: 94020 **Depth:** 0-5'
Date: 5/8/2024

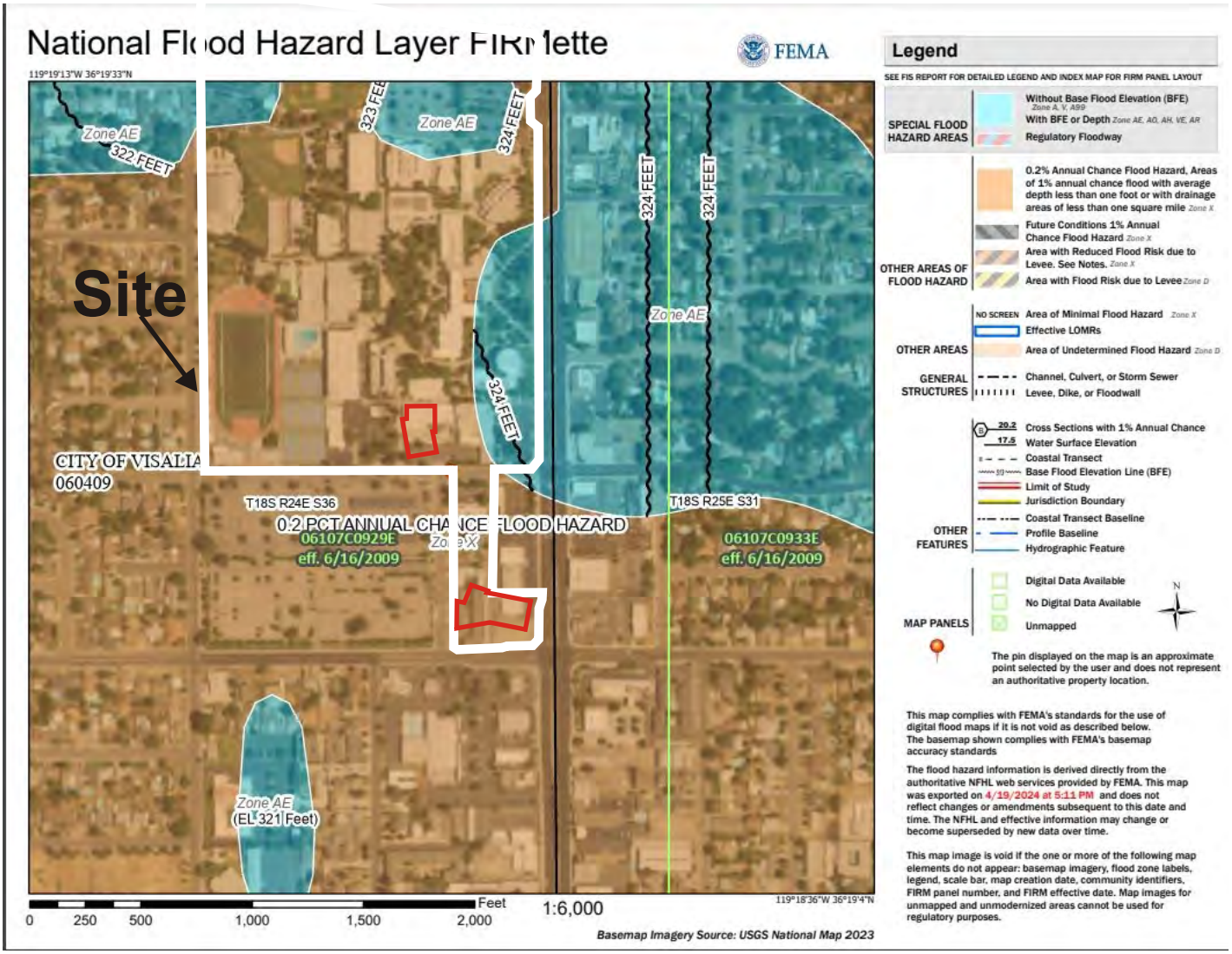
Tested by: RC
Checked by: AL
Remarks:
Test Date: 05/06/24

R-VALUE TEST REPORT

SOILS ENGINEERING, INC.

Figure D-2

N



SOILS ENGINEERING, INC. **4400 Yeager Way** **Bakersfield, CA 93313** **(661) 831 - 5100** DATE: 4/24 PROJECT: #19596	**College of the Sequoias** **University Center & Student Union Buildings** **915 S. Mooney Blvd** **Visalia, CA** **FEMA Flood Insurance Rate Map**	**PLATE**



DWR, Water Data Library, Station Map

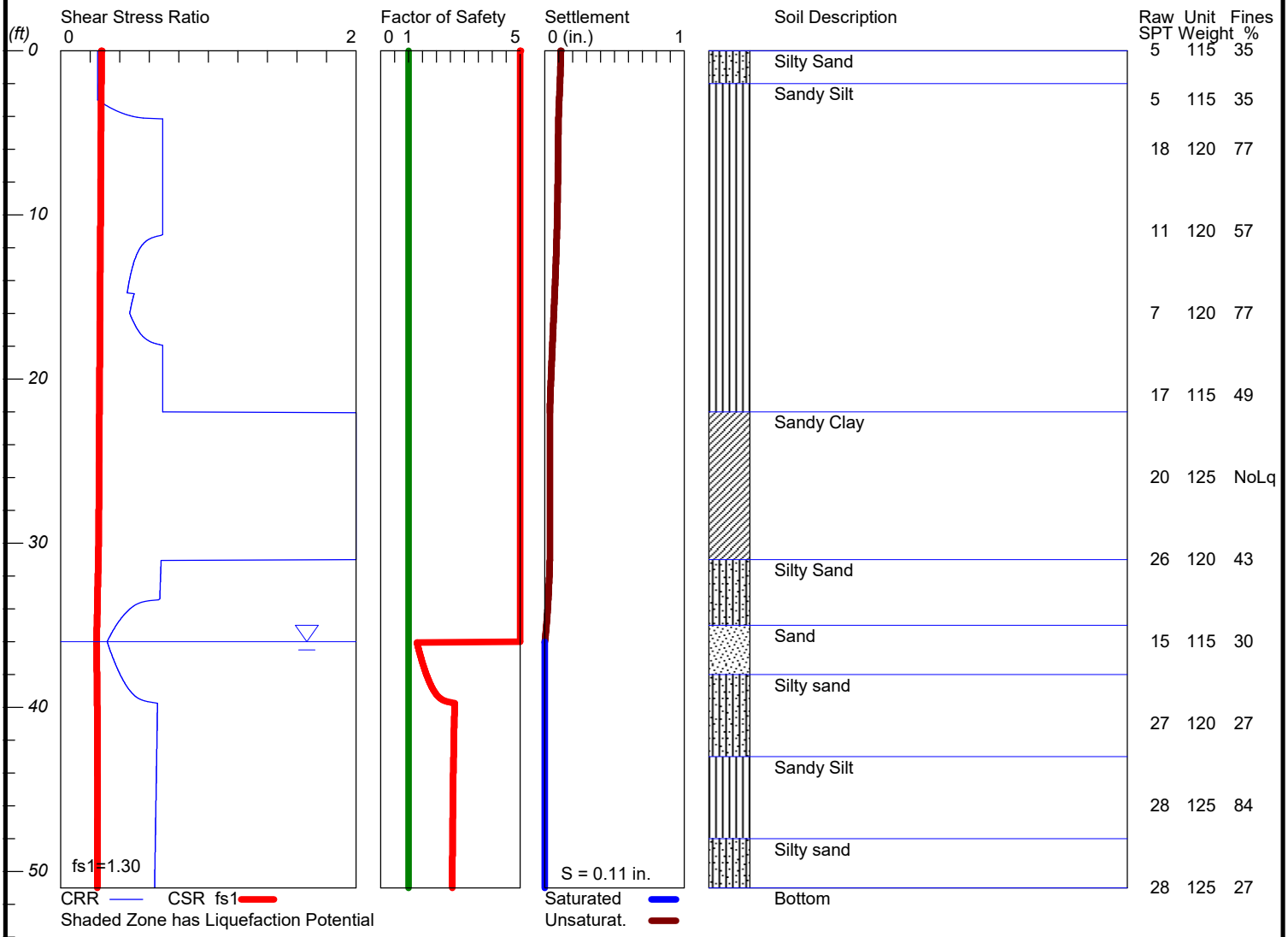
SOILS ENGINEERING, INC. **4400 Yeager Way** **Bakersfield, CA 93313** **(661) 831-5100** DATE: 4/24 PROJECT: #19596	**College of the Sequoias** **University Center & Student Union Buildings** **915 S. Mooney Blvd** **Visalia, CA** **Historical Depth To Water Map**	**PLATE**

LIQUEFACTION ANALYSIS

19596 COS

Hole No.=B-3 Water Depth=36 ft

Magnitude=6.61
Acceleration=0.327g



LiquefyPro CivilTech Software USA www.civiltech.com

****
LIQUEFACTION ANALYSIS SUMMARY
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****

Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to SEI, 5/7/2024 5:06:20 PM

Input File Name: O:\b. PROJECT FILES (ACTIVE)\19500-19599\19596 COS, University Center & Student Union Bldgs GEOTECH\OFFICE REPORTS\Liquefypro Files\19596 B-3 Liqufey.liq
Title: 19596 COS
Subtitle: 19596 B-3

Surface Elev.=
Hole No.=B-3
Depth of Hole= 51.00 ft
Water Table during Earthquake= 36.00 ft
Water Table during In-Situ Testing= 36.00 ft
Max. Acceleration= 0.33 g
Earthquake Magnitude= 6.61

Input Data:
Surface Elev.=
Hole No.=B-3
Depth of Hole=51.00 ft
Water Table during Earthquake= 36.00 ft
Water Table during In-Situ Testing= 36.00 ft
Max. Acceleration=0.33 g
Earthquake Magnitude=6.61
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Modify Stark/Olson
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR), User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	5.00	115.00	35.00
3.00	5.00	115.00	35.00
6.00	18.00	120.00	77.00
11.00	11.00	120.00	57.00
16.00	7.00	120.00	77.00
21.00	17.00	115.00	49.00
26.00	20.00	125.00	NoLiq
31.00	26.00	120.00	43.00
36.00	15.00	115.00	30.00
41.00	27.00	120.00	27.00
46.00	28.00	125.00	84.00
51.00	28.00	125.00	27.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.11 in.
Total Settlement of Saturated and Unsaturated Sands=0.11 in.
Differential Settlement=0.057 to 0.075 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.25	0.28	5.00	0.00	0.11	0.11
0.05	0.25	0.28	5.00	0.00	0.11	0.11
0.10	0.25	0.28	5.00	0.00	0.11	0.11
0.15	0.25	0.28	5.00	0.00	0.11	0.11
0.20	0.25	0.28	5.00	0.00	0.11	0.11
0.25	0.25	0.28	5.00	0.00	0.11	0.11
0.30	0.25	0.28	5.00	0.00	0.11	0.11
0.35	0.25	0.28	5.00	0.00	0.11	0.11
0.40	0.25	0.28	5.00	0.00	0.11	0.11
0.45	0.25	0.28	5.00	0.00	0.11	0.11
0.50	0.25	0.28	5.00	0.00	0.11	0.11
0.55	0.25	0.28	5.00	0.00	0.11	0.11
0.60	0.25	0.28	5.00	0.00	0.11	0.11
0.65	0.25	0.28	5.00	0.00	0.11	0.11
0.70	0.25	0.28	5.00	0.00	0.11	0.11
0.75	0.25	0.28	5.00	0.00	0.11	0.11
0.80	0.25	0.28	5.00	0.00	0.11	0.11
0.85	0.25	0.28	5.00	0.00	0.11	0.11
0.90	0.25	0.28	5.00	0.00	0.11	0.11
0.95	0.25	0.28	5.00	0.00	0.11	0.11
1.00	0.25	0.28	5.00	0.00	0.11	0.11
1.05	0.25	0.28	5.00	0.00	0.11	0.11
1.10	0.25	0.28	5.00	0.00	0.11	0.11
1.15	0.25	0.28	5.00	0.00	0.11	0.11
1.20	0.25	0.28	5.00	0.00	0.11	0.11
1.25	0.25	0.28	5.00	0.00	0.11	0.11
1.30	0.25	0.28	5.00	0.00	0.11	0.11

1.35	0.25	0.28	5.00	0.00	0.11	0.11
1.40	0.25	0.28	5.00	0.00	0.11	0.11
1.45	0.25	0.28	5.00	0.00	0.11	0.11
1.50	0.25	0.28	5.00	0.00	0.11	0.11
1.55	0.25	0.28	5.00	0.00	0.11	0.11
1.60	0.25	0.28	5.00	0.00	0.11	0.11
1.65	0.25	0.28	5.00	0.00	0.11	0.11
1.70	0.25	0.28	5.00	0.00	0.11	0.11
1.75	0.25	0.28	5.00	0.00	0.11	0.11
1.80	0.25	0.28	5.00	0.00	0.11	0.11
1.85	0.25	0.28	5.00	0.00	0.11	0.11
1.90	0.25	0.28	5.00	0.00	0.11	0.11
1.95	0.25	0.28	5.00	0.00	0.11	0.11
2.00	0.25	0.28	5.00	0.00	0.11	0.11
2.05	0.25	0.27	5.00	0.00	0.11	0.11
2.10	0.25	0.27	5.00	0.00	0.11	0.11
2.15	0.25	0.27	5.00	0.00	0.11	0.11
2.20	0.25	0.27	5.00	0.00	0.11	0.11
2.25	0.25	0.27	5.00	0.00	0.11	0.11
2.30	0.25	0.27	5.00	0.00	0.11	0.11
2.35	0.25	0.27	5.00	0.00	0.11	0.11
2.40	0.25	0.27	5.00	0.00	0.11	0.11
2.45	0.25	0.27	5.00	0.00	0.11	0.11
2.50	0.25	0.27	5.00	0.00	0.11	0.11
2.55	0.25	0.27	5.00	0.00	0.11	0.11
2.60	0.25	0.27	5.00	0.00	0.11	0.11
2.65	0.25	0.27	5.00	0.00	0.11	0.11
2.70	0.25	0.27	5.00	0.00	0.11	0.11
2.75	0.25	0.27	5.00	0.00	0.10	0.10
2.80	0.25	0.27	5.00	0.00	0.10	0.10
2.85	0.25	0.27	5.00	0.00	0.10	0.10
2.90	0.25	0.27	5.00	0.00	0.10	0.10
2.95	0.25	0.27	5.00	0.00	0.10	0.10
3.00	0.25	0.27	5.00	0.00	0.10	0.10
3.05	0.26	0.27	5.00	0.00	0.10	0.10
3.10	0.27	0.27	5.00	0.00	0.10	0.10
3.15	0.28	0.27	5.00	0.00	0.10	0.10
3.20	0.28	0.27	5.00	0.00	0.10	0.10
3.25	0.29	0.27	5.00	0.00	0.10	0.10
3.30	0.30	0.27	5.00	0.00	0.10	0.10
3.35	0.31	0.27	5.00	0.00	0.10	0.10
3.40	0.32	0.27	5.00	0.00	0.10	0.10
3.45	0.33	0.27	5.00	0.00	0.10	0.10
3.50	0.34	0.27	5.00	0.00	0.10	0.10
3.55	0.35	0.27	5.00	0.00	0.10	0.10
3.60	0.36	0.27	5.00	0.00	0.10	0.10
3.65	0.38	0.27	5.00	0.00	0.10	0.10
3.70	0.39	0.27	5.00	0.00	0.10	0.10
3.75	0.40	0.27	5.00	0.00	0.10	0.10
3.80	0.42	0.27	5.00	0.00	0.10	0.10
3.85	0.43	0.27	5.00	0.00	0.10	0.10
3.90	0.45	0.27	5.00	0.00	0.10	0.10
3.95	0.47	0.27	5.00	0.00	0.10	0.10
4.00	0.49	0.27	5.00	0.00	0.10	0.10

4.05	0.52	0.27	5.00	0.00	0.10	0.10
4.10	0.56	0.27	5.00	0.00	0.10	0.10
4.15	0.69	0.27	5.00	0.00	0.10	0.10
4.20	0.69	0.27	5.00	0.00	0.10	0.10
4.25	0.69	0.27	5.00	0.00	0.10	0.10
4.30	0.69	0.27	5.00	0.00	0.10	0.10
4.35	0.69	0.27	5.00	0.00	0.10	0.10
4.40	0.69	0.27	5.00	0.00	0.10	0.10
4.45	0.69	0.27	5.00	0.00	0.10	0.10
4.50	0.69	0.27	5.00	0.00	0.10	0.10
4.55	0.69	0.27	5.00	0.00	0.10	0.10
4.60	0.69	0.27	5.00	0.00	0.10	0.10
4.65	0.69	0.27	5.00	0.00	0.10	0.10
4.70	0.69	0.27	5.00	0.00	0.10	0.10
4.75	0.69	0.27	5.00	0.00	0.10	0.10
4.80	0.69	0.27	5.00	0.00	0.10	0.10
4.85	0.69	0.27	5.00	0.00	0.10	0.10
4.90	0.69	0.27	5.00	0.00	0.10	0.10
4.95	0.69	0.27	5.00	0.00	0.10	0.10
5.00	0.69	0.27	5.00	0.00	0.10	0.10
5.05	0.69	0.27	5.00	0.00	0.10	0.10
5.10	0.69	0.27	5.00	0.00	0.10	0.10
5.15	0.69	0.27	5.00	0.00	0.10	0.10
5.20	0.69	0.27	5.00	0.00	0.10	0.10
5.25	0.69	0.27	5.00	0.00	0.10	0.10
5.30	0.69	0.27	5.00	0.00	0.10	0.10
5.35	0.69	0.27	5.00	0.00	0.10	0.10
5.40	0.69	0.27	5.00	0.00	0.10	0.10
5.45	0.69	0.27	5.00	0.00	0.10	0.10
5.50	0.69	0.27	5.00	0.00	0.10	0.10
5.55	0.69	0.27	5.00	0.00	0.10	0.10
5.60	0.69	0.27	5.00	0.00	0.10	0.10
5.65	0.69	0.27	5.00	0.00	0.10	0.10
5.70	0.69	0.27	5.00	0.00	0.10	0.10
5.75	0.69	0.27	5.00	0.00	0.10	0.10
5.80	0.69	0.27	5.00	0.00	0.10	0.10
5.85	0.69	0.27	5.00	0.00	0.10	0.10
5.90	0.69	0.27	5.00	0.00	0.10	0.10
5.95	0.69	0.27	5.00	0.00	0.10	0.10
6.00	0.69	0.27	5.00	0.00	0.10	0.10
6.05	0.69	0.27	5.00	0.00	0.10	0.10
6.10	0.69	0.27	5.00	0.00	0.10	0.10
6.15	0.69	0.27	5.00	0.00	0.10	0.10
6.20	0.69	0.27	5.00	0.00	0.10	0.10
6.25	0.69	0.27	5.00	0.00	0.10	0.10
6.30	0.69	0.27	5.00	0.00	0.10	0.10
6.35	0.69	0.27	5.00	0.00	0.10	0.10
6.40	0.69	0.27	5.00	0.00	0.10	0.10
6.45	0.69	0.27	5.00	0.00	0.10	0.10
6.50	0.69	0.27	5.00	0.00	0.10	0.10
6.55	0.69	0.27	5.00	0.00	0.10	0.10
6.60	0.69	0.27	5.00	0.00	0.10	0.10
6.65	0.69	0.27	5.00	0.00	0.10	0.10
6.70	0.69	0.27	5.00	0.00	0.10	0.10

6.75	0.69	0.27	5.00	0.00	0.10	0.10
6.80	0.69	0.27	5.00	0.00	0.10	0.10
6.85	0.69	0.27	5.00	0.00	0.09	0.09
6.90	0.69	0.27	5.00	0.00	0.09	0.09
6.95	0.69	0.27	5.00	0.00	0.09	0.09
7.00	0.69	0.27	5.00	0.00	0.09	0.09
7.05	0.69	0.27	5.00	0.00	0.09	0.09
7.10	0.69	0.27	5.00	0.00	0.09	0.09
7.15	0.69	0.27	5.00	0.00	0.09	0.09
7.20	0.69	0.27	5.00	0.00	0.09	0.09
7.25	0.69	0.27	5.00	0.00	0.09	0.09
7.30	0.69	0.27	5.00	0.00	0.09	0.09
7.35	0.69	0.27	5.00	0.00	0.09	0.09
7.40	0.69	0.27	5.00	0.00	0.09	0.09
7.45	0.69	0.27	5.00	0.00	0.09	0.09
7.50	0.69	0.27	5.00	0.00	0.09	0.09
7.55	0.69	0.27	5.00	0.00	0.09	0.09
7.60	0.69	0.27	5.00	0.00	0.09	0.09
7.65	0.69	0.27	5.00	0.00	0.09	0.09
7.70	0.69	0.27	5.00	0.00	0.09	0.09
7.75	0.69	0.27	5.00	0.00	0.09	0.09
7.80	0.69	0.27	5.00	0.00	0.09	0.09
7.85	0.69	0.27	5.00	0.00	0.09	0.09
7.90	0.69	0.27	5.00	0.00	0.09	0.09
7.95	0.69	0.27	5.00	0.00	0.09	0.09
8.00	0.69	0.27	5.00	0.00	0.09	0.09
8.05	0.69	0.27	5.00	0.00	0.09	0.09
8.10	0.69	0.27	5.00	0.00	0.09	0.09
8.15	0.69	0.27	5.00	0.00	0.09	0.09
8.20	0.69	0.27	5.00	0.00	0.09	0.09
8.25	0.69	0.27	5.00	0.00	0.09	0.09
8.30	0.69	0.27	5.00	0.00	0.09	0.09
8.35	0.69	0.27	5.00	0.00	0.09	0.09
8.40	0.69	0.27	5.00	0.00	0.09	0.09
8.45	0.69	0.27	5.00	0.00	0.09	0.09
8.50	0.69	0.27	5.00	0.00	0.09	0.09
8.55	0.69	0.27	5.00	0.00	0.09	0.09
8.60	0.69	0.27	5.00	0.00	0.09	0.09
8.65	0.69	0.27	5.00	0.00	0.09	0.09
8.70	0.69	0.27	5.00	0.00	0.09	0.09
8.75	0.69	0.27	5.00	0.00	0.09	0.09
8.80	0.69	0.27	5.00	0.00	0.09	0.09
8.85	0.69	0.27	5.00	0.00	0.09	0.09
8.90	0.69	0.27	5.00	0.00	0.09	0.09
8.95	0.69	0.27	5.00	0.00	0.09	0.09
9.00	0.69	0.27	5.00	0.00	0.09	0.09
9.05	0.69	0.27	5.00	0.00	0.09	0.09
9.10	0.69	0.27	5.00	0.00	0.09	0.09
9.15	0.69	0.27	5.00	0.00	0.09	0.09
9.20	0.69	0.27	5.00	0.00	0.09	0.09
9.25	0.69	0.27	5.00	0.00	0.09	0.09
9.30	0.69	0.27	5.00	0.00	0.09	0.09
9.35	0.69	0.27	5.00	0.00	0.09	0.09
9.40	0.69	0.27	5.00	0.00	0.09	0.09

9.45	0.69	0.27	5.00	0.00	0.09	0.09
9.50	0.69	0.27	5.00	0.00	0.09	0.09
9.55	0.69	0.27	5.00	0.00	0.09	0.09
9.60	0.69	0.27	5.00	0.00	0.09	0.09
9.65	0.69	0.27	5.00	0.00	0.09	0.09
9.70	0.69	0.27	5.00	0.00	0.09	0.09
9.75	0.69	0.27	5.00	0.00	0.09	0.09
9.80	0.69	0.27	5.00	0.00	0.09	0.09
9.85	0.69	0.27	5.00	0.00	0.09	0.09
9.90	0.69	0.27	5.00	0.00	0.09	0.09
9.95	0.69	0.27	5.00	0.00	0.09	0.09
10.00	0.69	0.27	5.00	0.00	0.09	0.09
10.05	0.69	0.27	5.00	0.00	0.09	0.09
10.10	0.69	0.27	5.00	0.00	0.09	0.09
10.15	0.69	0.27	5.00	0.00	0.09	0.09
10.20	0.69	0.27	5.00	0.00	0.09	0.09
10.25	0.69	0.27	5.00	0.00	0.09	0.09
10.30	0.69	0.27	5.00	0.00	0.09	0.09
10.35	0.69	0.27	5.00	0.00	0.09	0.09
10.40	0.69	0.27	5.00	0.00	0.09	0.09
10.45	0.69	0.27	5.00	0.00	0.09	0.09
10.50	0.69	0.27	5.00	0.00	0.09	0.09
10.55	0.69	0.27	5.00	0.00	0.09	0.09
10.60	0.69	0.27	5.00	0.00	0.09	0.09
10.65	0.69	0.27	5.00	0.00	0.09	0.09
10.70	0.69	0.27	5.00	0.00	0.09	0.09
10.75	0.69	0.27	5.00	0.00	0.09	0.09
10.80	0.69	0.27	5.00	0.00	0.09	0.09
10.85	0.69	0.27	5.00	0.00	0.09	0.09
10.90	0.69	0.27	5.00	0.00	0.09	0.09
10.95	0.69	0.27	5.00	0.00	0.09	0.09
11.00	0.69	0.27	5.00	0.00	0.09	0.09
11.05	0.69	0.27	5.00	0.00	0.09	0.09
11.10	0.69	0.27	5.00	0.00	0.09	0.09
11.15	0.69	0.27	5.00	0.00	0.09	0.09
11.20	0.69	0.27	5.00	0.00	0.09	0.09
11.25	0.68	0.27	5.00	0.00	0.09	0.09
11.30	0.65	0.27	5.00	0.00	0.09	0.09
11.35	0.63	0.27	5.00	0.00	0.09	0.09
11.40	0.62	0.27	5.00	0.00	0.09	0.09
11.45	0.61	0.27	5.00	0.00	0.09	0.09
11.50	0.59	0.27	5.00	0.00	0.09	0.09
11.55	0.59	0.27	5.00	0.00	0.09	0.09
11.60	0.58	0.27	5.00	0.00	0.08	0.08
11.65	0.57	0.27	5.00	0.00	0.08	0.08
11.70	0.57	0.27	5.00	0.00	0.08	0.08
11.75	0.56	0.27	5.00	0.00	0.08	0.08
11.80	0.56	0.27	5.00	0.00	0.08	0.08
11.85	0.55	0.27	5.00	0.00	0.08	0.08
11.90	0.55	0.27	5.00	0.00	0.08	0.08
11.95	0.54	0.27	5.00	0.00	0.08	0.08
12.00	0.54	0.27	5.00	0.00	0.08	0.08
12.05	0.54	0.27	5.00	0.00	0.08	0.08
12.10	0.53	0.27	5.00	0.00	0.08	0.08

12.15	0.53	0.27	5.00	0.00	0.08	0.08
12.20	0.53	0.27	5.00	0.00	0.08	0.08
12.25	0.52	0.27	5.00	0.00	0.08	0.08
12.30	0.52	0.27	5.00	0.00	0.08	0.08
12.35	0.52	0.27	5.00	0.00	0.08	0.08
12.40	0.52	0.27	5.00	0.00	0.08	0.08
12.45	0.51	0.27	5.00	0.00	0.08	0.08
12.50	0.51	0.27	5.00	0.00	0.08	0.08
12.55	0.51	0.27	5.00	0.00	0.08	0.08
12.60	0.51	0.27	5.00	0.00	0.08	0.08
12.65	0.50	0.27	5.00	0.00	0.08	0.08
12.70	0.50	0.27	5.00	0.00	0.08	0.08
12.75	0.50	0.27	5.00	0.00	0.08	0.08
12.80	0.50	0.27	5.00	0.00	0.08	0.08
12.85	0.50	0.27	5.00	0.00	0.08	0.08
12.90	0.50	0.27	5.00	0.00	0.08	0.08
12.95	0.49	0.27	5.00	0.00	0.08	0.08
13.00	0.49	0.27	5.00	0.00	0.08	0.08
13.05	0.49	0.27	5.00	0.00	0.08	0.08
13.10	0.49	0.27	5.00	0.00	0.08	0.08
13.15	0.49	0.27	5.00	0.00	0.08	0.08
13.20	0.49	0.27	5.00	0.00	0.08	0.08
13.25	0.48	0.27	5.00	0.00	0.08	0.08
13.30	0.48	0.27	5.00	0.00	0.08	0.08
13.35	0.48	0.27	5.00	0.00	0.08	0.08
13.40	0.48	0.27	5.00	0.00	0.08	0.08
13.45	0.48	0.27	5.00	0.00	0.08	0.08
13.50	0.48	0.27	5.00	0.00	0.08	0.08
13.55	0.48	0.27	5.00	0.00	0.08	0.08
13.60	0.47	0.27	5.00	0.00	0.08	0.08
13.65	0.47	0.27	5.00	0.00	0.08	0.08
13.70	0.47	0.27	5.00	0.00	0.08	0.08
13.75	0.47	0.27	5.00	0.00	0.08	0.08
13.80	0.47	0.27	5.00	0.00	0.08	0.08
13.85	0.47	0.27	5.00	0.00	0.08	0.08
13.90	0.47	0.27	5.00	0.00	0.08	0.08
13.95	0.47	0.27	5.00	0.00	0.08	0.08
14.00	0.46	0.27	5.00	0.00	0.07	0.07
14.05	0.46	0.27	5.00	0.00	0.07	0.07
14.10	0.46	0.27	5.00	0.00	0.07	0.07
14.15	0.46	0.27	5.00	0.00	0.07	0.07
14.20	0.46	0.27	5.00	0.00	0.07	0.07
14.25	0.46	0.27	5.00	0.00	0.07	0.07
14.30	0.46	0.27	5.00	0.00	0.07	0.07
14.35	0.46	0.27	5.00	0.00	0.07	0.07
14.40	0.46	0.27	5.00	0.00	0.07	0.07
14.45	0.46	0.27	5.00	0.00	0.07	0.07
14.50	0.45	0.27	5.00	0.00	0.07	0.07
14.55	0.45	0.27	5.00	0.00	0.07	0.07
14.60	0.45	0.27	5.00	0.00	0.07	0.07
14.65	0.45	0.27	5.00	0.00	0.07	0.07
14.70	0.45	0.27	5.00	0.00	0.07	0.07
14.75	0.45	0.27	5.00	0.00	0.07	0.07
14.80	0.50	0.27	5.00	0.00	0.07	0.07

14.85	0.50	0.27	5.00	0.00	0.07	0.07
14.90	0.49	0.27	5.00	0.00	0.07	0.07
14.95	0.49	0.27	5.00	0.00	0.07	0.07
15.00	0.49	0.27	5.00	0.00	0.07	0.07
15.05	0.49	0.27	5.00	0.00	0.07	0.07
15.10	0.49	0.27	5.00	0.00	0.07	0.07
15.15	0.49	0.27	5.00	0.00	0.07	0.07
15.20	0.49	0.27	5.00	0.00	0.07	0.07
15.25	0.48	0.27	5.00	0.00	0.07	0.07
15.30	0.48	0.27	5.00	0.00	0.07	0.07
15.35	0.48	0.27	5.00	0.00	0.07	0.07
15.40	0.48	0.27	5.00	0.00	0.07	0.07
15.45	0.48	0.27	5.00	0.00	0.07	0.07
15.50	0.48	0.27	5.00	0.00	0.07	0.07
15.55	0.48	0.27	5.00	0.00	0.07	0.07
15.60	0.48	0.27	5.00	0.00	0.07	0.07
15.65	0.47	0.27	5.00	0.00	0.07	0.07
15.70	0.47	0.27	5.00	0.00	0.07	0.07
15.75	0.47	0.27	5.00	0.00	0.07	0.07
15.80	0.47	0.27	5.00	0.00	0.07	0.07
15.85	0.47	0.27	5.00	0.00	0.07	0.07
15.90	0.47	0.27	5.00	0.00	0.07	0.07
15.95	0.47	0.27	5.00	0.00	0.07	0.07
16.00	0.47	0.27	5.00	0.00	0.06	0.06
16.05	0.47	0.27	5.00	0.00	0.06	0.06
16.10	0.47	0.27	5.00	0.00	0.06	0.06
16.15	0.47	0.27	5.00	0.00	0.06	0.06
16.20	0.48	0.27	5.00	0.00	0.06	0.06
16.25	0.48	0.27	5.00	0.00	0.06	0.06
16.30	0.48	0.27	5.00	0.00	0.06	0.06
16.35	0.48	0.27	5.00	0.00	0.06	0.06
16.40	0.49	0.27	5.00	0.00	0.06	0.06
16.45	0.49	0.27	5.00	0.00	0.06	0.06
16.50	0.49	0.27	5.00	0.00	0.06	0.06
16.55	0.49	0.27	5.00	0.00	0.06	0.06
16.60	0.50	0.27	5.00	0.00	0.06	0.06
16.65	0.50	0.27	5.00	0.00	0.06	0.06
16.70	0.50	0.27	5.00	0.00	0.06	0.06
16.75	0.51	0.27	5.00	0.00	0.06	0.06
16.80	0.51	0.27	5.00	0.00	0.06	0.06
16.85	0.51	0.27	5.00	0.00	0.06	0.06
16.90	0.52	0.27	5.00	0.00	0.06	0.06
16.95	0.52	0.27	5.00	0.00	0.06	0.06
17.00	0.52	0.27	5.00	0.00	0.06	0.06
17.05	0.53	0.27	5.00	0.00	0.06	0.06
17.10	0.53	0.27	5.00	0.00	0.06	0.06
17.15	0.53	0.27	5.00	0.00	0.06	0.06
17.20	0.54	0.27	5.00	0.00	0.06	0.06
17.25	0.54	0.27	5.00	0.00	0.06	0.06
17.30	0.55	0.27	5.00	0.00	0.06	0.06
17.35	0.55	0.27	5.00	0.00	0.06	0.06
17.40	0.56	0.27	5.00	0.00	0.06	0.06
17.45	0.56	0.27	5.00	0.00	0.06	0.06
17.50	0.57	0.27	5.00	0.00	0.06	0.06

17.55	0.58	0.27	5.00	0.00	0.06	0.06
17.60	0.58	0.26	5.00	0.00	0.06	0.06
17.65	0.59	0.26	5.00	0.00	0.06	0.06
17.70	0.60	0.26	5.00	0.00	0.06	0.06
17.75	0.61	0.26	5.00	0.00	0.06	0.06
17.80	0.63	0.26	5.00	0.00	0.06	0.06
17.85	0.65	0.26	5.00	0.00	0.06	0.06
17.90	0.67	0.26	5.00	0.00	0.06	0.06
17.95	0.69	0.26	5.00	0.00	0.05	0.05
18.00	0.69	0.26	5.00	0.00	0.05	0.05
18.05	0.69	0.26	5.00	0.00	0.05	0.05
18.10	0.69	0.26	5.00	0.00	0.05	0.05
18.15	0.69	0.26	5.00	0.00	0.05	0.05
18.20	0.69	0.26	5.00	0.00	0.05	0.05
18.25	0.69	0.26	5.00	0.00	0.05	0.05
18.30	0.69	0.26	5.00	0.00	0.05	0.05
18.35	0.69	0.26	5.00	0.00	0.05	0.05
18.40	0.69	0.26	5.00	0.00	0.05	0.05
18.45	0.69	0.26	5.00	0.00	0.05	0.05
18.50	0.69	0.26	5.00	0.00	0.05	0.05
18.55	0.69	0.26	5.00	0.00	0.05	0.05
18.60	0.69	0.26	5.00	0.00	0.05	0.05
18.65	0.69	0.26	5.00	0.00	0.05	0.05
18.70	0.69	0.26	5.00	0.00	0.05	0.05
18.75	0.69	0.26	5.00	0.00	0.05	0.05
18.80	0.69	0.26	5.00	0.00	0.05	0.05
18.85	0.69	0.26	5.00	0.00	0.05	0.05
18.90	0.69	0.26	5.00	0.00	0.05	0.05
18.95	0.69	0.26	5.00	0.00	0.05	0.05
19.00	0.69	0.26	5.00	0.00	0.05	0.05
19.05	0.69	0.26	5.00	0.00	0.05	0.05
19.10	0.69	0.26	5.00	0.00	0.05	0.05
19.15	0.69	0.26	5.00	0.00	0.05	0.05
19.20	0.69	0.26	5.00	0.00	0.05	0.05
19.25	0.69	0.26	5.00	0.00	0.05	0.05
19.30	0.69	0.26	5.00	0.00	0.05	0.05
19.35	0.69	0.26	5.00	0.00	0.05	0.05
19.40	0.69	0.26	5.00	0.00	0.05	0.05
19.45	0.69	0.26	5.00	0.00	0.05	0.05
19.50	0.69	0.26	5.00	0.00	0.05	0.05
19.55	0.69	0.26	5.00	0.00	0.05	0.05
19.60	0.69	0.26	5.00	0.00	0.05	0.05
19.65	0.69	0.26	5.00	0.00	0.05	0.05
19.70	0.69	0.26	5.00	0.00	0.05	0.05
19.75	0.69	0.26	5.00	0.00	0.05	0.05
19.80	0.69	0.26	5.00	0.00	0.05	0.05
19.85	0.69	0.26	5.00	0.00	0.05	0.05
19.90	0.69	0.26	5.00	0.00	0.05	0.05
19.95	0.69	0.26	5.00	0.00	0.04	0.04
20.00	0.69	0.26	5.00	0.00	0.04	0.04
20.05	0.69	0.26	5.00	0.00	0.04	0.04
20.10	0.69	0.26	5.00	0.00	0.04	0.04
20.15	0.69	0.26	5.00	0.00	0.04	0.04
20.20	0.69	0.26	5.00	0.00	0.04	0.04

20.25	0.69	0.26	5.00	0.00	0.04	0.04
20.30	0.69	0.26	5.00	0.00	0.04	0.04
20.35	0.69	0.26	5.00	0.00	0.04	0.04
20.40	0.69	0.26	5.00	0.00	0.04	0.04
20.45	0.69	0.26	5.00	0.00	0.04	0.04
20.50	0.69	0.26	5.00	0.00	0.04	0.04
20.55	0.69	0.26	5.00	0.00	0.04	0.04
20.60	0.69	0.26	5.00	0.00	0.04	0.04
20.65	0.69	0.26	5.00	0.00	0.04	0.04
20.70	0.69	0.26	5.00	0.00	0.04	0.04
20.75	0.69	0.26	5.00	0.00	0.04	0.04
20.80	0.69	0.26	5.00	0.00	0.04	0.04
20.85	0.69	0.26	5.00	0.00	0.04	0.04
20.90	0.69	0.26	5.00	0.00	0.04	0.04
20.95	0.69	0.26	5.00	0.00	0.04	0.04
21.00	0.69	0.26	5.00	0.00	0.04	0.04
21.05	0.69	0.26	5.00	0.00	0.04	0.04
21.10	0.69	0.26	5.00	0.00	0.04	0.04
21.15	0.69	0.26	5.00	0.00	0.04	0.04
21.20	0.69	0.26	5.00	0.00	0.04	0.04
21.25	0.69	0.26	5.00	0.00	0.04	0.04
21.30	0.69	0.26	5.00	0.00	0.04	0.04
21.35	0.69	0.26	5.00	0.00	0.04	0.04
21.40	0.69	0.26	5.00	0.00	0.04	0.04
21.45	0.69	0.26	5.00	0.00	0.04	0.04
21.50	0.69	0.26	5.00	0.00	0.04	0.04
21.55	0.69	0.26	5.00	0.00	0.04	0.04
21.60	0.69	0.26	5.00	0.00	0.04	0.04
21.65	0.69	0.26	5.00	0.00	0.04	0.04
21.70	0.69	0.26	5.00	0.00	0.04	0.04
21.75	0.69	0.26	5.00	0.00	0.04	0.04
21.80	0.69	0.26	5.00	0.00	0.04	0.04
21.85	0.69	0.26	5.00	0.00	0.04	0.04
21.90	0.69	0.26	5.00	0.00	0.04	0.04
21.95	0.69	0.26	5.00	0.00	0.04	0.04
22.00	0.69	0.26	5.00	0.00	0.04	0.04
22.05	2.00	0.26	5.00	0.00	0.04	0.04
22.10	2.00	0.26	5.00	0.00	0.04	0.04
22.15	2.00	0.26	5.00	0.00	0.04	0.04
22.20	2.00	0.26	5.00	0.00	0.04	0.04
22.25	2.00	0.26	5.00	0.00	0.04	0.04
22.30	2.00	0.26	5.00	0.00	0.04	0.04
22.35	2.00	0.26	5.00	0.00	0.04	0.04
22.40	2.00	0.26	5.00	0.00	0.04	0.04
22.45	2.00	0.26	5.00	0.00	0.04	0.04
22.50	2.00	0.26	5.00	0.00	0.04	0.04
22.55	2.00	0.26	5.00	0.00	0.04	0.04
22.60	2.00	0.26	5.00	0.00	0.04	0.04
22.65	2.00	0.26	5.00	0.00	0.04	0.04
22.70	2.00	0.26	5.00	0.00	0.04	0.04
22.75	2.00	0.26	5.00	0.00	0.04	0.04
22.80	2.00	0.26	5.00	0.00	0.04	0.04
22.85	2.00	0.26	5.00	0.00	0.04	0.04
22.90	2.00	0.26	5.00	0.00	0.04	0.04

22.95	2.00	0.26	5.00	0.00	0.04	0.04
23.00	2.00	0.26	5.00	0.00	0.04	0.04
23.05	2.00	0.26	5.00	0.00	0.04	0.04
23.10	2.00	0.26	5.00	0.00	0.04	0.04
23.15	2.00	0.26	5.00	0.00	0.04	0.04
23.20	2.00	0.26	5.00	0.00	0.04	0.04
23.25	2.00	0.26	5.00	0.00	0.04	0.04
23.30	2.00	0.26	5.00	0.00	0.04	0.04
23.35	2.00	0.26	5.00	0.00	0.04	0.04
23.40	2.00	0.26	5.00	0.00	0.04	0.04
23.45	2.00	0.26	5.00	0.00	0.04	0.04
23.50	2.00	0.26	5.00	0.00	0.04	0.04
23.55	2.00	0.26	5.00	0.00	0.04	0.04
23.60	2.00	0.26	5.00	0.00	0.04	0.04
23.65	2.00	0.26	5.00	0.00	0.04	0.04
23.70	2.00	0.26	5.00	0.00	0.04	0.04
23.75	2.00	0.26	5.00	0.00	0.04	0.04
23.80	2.00	0.26	5.00	0.00	0.04	0.04
23.85	2.00	0.26	5.00	0.00	0.04	0.04
23.90	2.00	0.26	5.00	0.00	0.04	0.04
23.95	2.00	0.26	5.00	0.00	0.04	0.04
24.00	2.00	0.26	5.00	0.00	0.04	0.04
24.05	2.00	0.26	5.00	0.00	0.04	0.04
24.10	2.00	0.26	5.00	0.00	0.04	0.04
24.15	2.00	0.26	5.00	0.00	0.04	0.04
24.20	2.00	0.26	5.00	0.00	0.04	0.04
24.25	2.00	0.26	5.00	0.00	0.04	0.04
24.30	2.00	0.26	5.00	0.00	0.04	0.04
24.35	2.00	0.26	5.00	0.00	0.04	0.04
24.40	2.00	0.26	5.00	0.00	0.04	0.04
24.45	2.00	0.26	5.00	0.00	0.04	0.04
24.50	2.00	0.26	5.00	0.00	0.04	0.04
24.55	2.00	0.26	5.00	0.00	0.04	0.04
24.60	2.00	0.26	5.00	0.00	0.04	0.04
24.65	2.00	0.26	5.00	0.00	0.04	0.04
24.70	2.00	0.26	5.00	0.00	0.04	0.04
24.75	2.00	0.26	5.00	0.00	0.04	0.04
24.80	2.00	0.26	5.00	0.00	0.04	0.04
24.85	2.00	0.26	5.00	0.00	0.04	0.04
24.90	2.00	0.26	5.00	0.00	0.04	0.04
24.95	2.00	0.26	5.00	0.00	0.04	0.04
25.00	2.00	0.26	5.00	0.00	0.04	0.04
25.05	2.00	0.26	5.00	0.00	0.04	0.04
25.10	2.00	0.26	5.00	0.00	0.04	0.04
25.15	2.00	0.26	5.00	0.00	0.04	0.04
25.20	2.00	0.26	5.00	0.00	0.04	0.04
25.25	2.00	0.26	5.00	0.00	0.04	0.04
25.30	2.00	0.26	5.00	0.00	0.04	0.04
25.35	2.00	0.26	5.00	0.00	0.04	0.04
25.40	2.00	0.26	5.00	0.00	0.04	0.04
25.45	2.00	0.26	5.00	0.00	0.04	0.04
25.50	2.00	0.26	5.00	0.00	0.04	0.04
25.55	2.00	0.26	5.00	0.00	0.04	0.04
25.60	2.00	0.26	5.00	0.00	0.04	0.04

25.65	2.00	0.26	5.00	0.00	0.04	0.04
25.70	2.00	0.26	5.00	0.00	0.04	0.04
25.75	2.00	0.26	5.00	0.00	0.04	0.04
25.80	2.00	0.26	5.00	0.00	0.04	0.04
25.85	2.00	0.26	5.00	0.00	0.04	0.04
25.90	2.00	0.26	5.00	0.00	0.04	0.04
25.95	2.00	0.26	5.00	0.00	0.04	0.04
26.00	2.00	0.26	5.00	0.00	0.04	0.04
26.05	2.00	0.26	5.00	0.00	0.04	0.04
26.10	2.00	0.26	5.00	0.00	0.04	0.04
26.15	2.00	0.26	5.00	0.00	0.04	0.04
26.20	2.00	0.26	5.00	0.00	0.04	0.04
26.25	2.00	0.26	5.00	0.00	0.04	0.04
26.30	2.00	0.26	5.00	0.00	0.04	0.04
26.35	2.00	0.26	5.00	0.00	0.04	0.04
26.40	2.00	0.26	5.00	0.00	0.04	0.04
26.45	2.00	0.26	5.00	0.00	0.04	0.04
26.50	2.00	0.26	5.00	0.00	0.04	0.04
26.55	2.00	0.26	5.00	0.00	0.04	0.04
26.60	2.00	0.26	5.00	0.00	0.04	0.04
26.65	2.00	0.26	5.00	0.00	0.04	0.04
26.70	2.00	0.26	5.00	0.00	0.04	0.04
26.75	2.00	0.26	5.00	0.00	0.04	0.04
26.80	2.00	0.26	5.00	0.00	0.04	0.04
26.85	2.00	0.26	5.00	0.00	0.04	0.04
26.90	2.00	0.26	5.00	0.00	0.04	0.04
26.95	2.00	0.26	5.00	0.00	0.04	0.04
27.00	2.00	0.26	5.00	0.00	0.04	0.04
27.05	2.00	0.26	5.00	0.00	0.04	0.04
27.10	2.00	0.26	5.00	0.00	0.04	0.04
27.15	2.00	0.26	5.00	0.00	0.04	0.04
27.20	2.00	0.26	5.00	0.00	0.04	0.04
27.25	2.00	0.26	5.00	0.00	0.04	0.04
27.30	2.00	0.26	5.00	0.00	0.04	0.04
27.35	2.00	0.26	5.00	0.00	0.04	0.04
27.40	2.00	0.26	5.00	0.00	0.04	0.04
27.45	2.00	0.26	5.00	0.00	0.04	0.04
27.50	2.00	0.26	5.00	0.00	0.04	0.04
27.55	2.00	0.26	5.00	0.00	0.04	0.04
27.60	2.00	0.26	5.00	0.00	0.04	0.04
27.65	2.00	0.26	5.00	0.00	0.04	0.04
27.70	2.00	0.26	5.00	0.00	0.04	0.04
27.75	2.00	0.26	5.00	0.00	0.04	0.04
27.80	2.00	0.26	5.00	0.00	0.04	0.04
27.85	2.00	0.26	5.00	0.00	0.04	0.04
27.90	2.00	0.26	5.00	0.00	0.04	0.04
27.95	2.00	0.26	5.00	0.00	0.04	0.04
28.00	2.00	0.26	5.00	0.00	0.04	0.04
28.05	2.00	0.26	5.00	0.00	0.04	0.04
28.10	2.00	0.26	5.00	0.00	0.04	0.04
28.15	2.00	0.26	5.00	0.00	0.04	0.04
28.20	2.00	0.26	5.00	0.00	0.04	0.04
28.25	2.00	0.26	5.00	0.00	0.04	0.04
28.30	2.00	0.26	5.00	0.00	0.04	0.04

28.35	2.00	0.26	5.00	0.00	0.04	0.04
28.40	2.00	0.26	5.00	0.00	0.04	0.04
28.45	2.00	0.26	5.00	0.00	0.04	0.04
28.50	2.00	0.26	5.00	0.00	0.04	0.04
28.55	2.00	0.26	5.00	0.00	0.04	0.04
28.60	2.00	0.26	5.00	0.00	0.04	0.04
28.65	2.00	0.26	5.00	0.00	0.04	0.04
28.70	2.00	0.26	5.00	0.00	0.04	0.04
28.75	2.00	0.26	5.00	0.00	0.04	0.04
28.80	2.00	0.26	5.00	0.00	0.04	0.04
28.85	2.00	0.26	5.00	0.00	0.04	0.04
28.90	2.00	0.26	5.00	0.00	0.04	0.04
28.95	2.00	0.26	5.00	0.00	0.04	0.04
29.00	2.00	0.26	5.00	0.00	0.04	0.04
29.05	2.00	0.26	5.00	0.00	0.04	0.04
29.10	2.00	0.26	5.00	0.00	0.04	0.04
29.15	2.00	0.26	5.00	0.00	0.04	0.04
29.20	2.00	0.26	5.00	0.00	0.04	0.04
29.25	2.00	0.26	5.00	0.00	0.04	0.04
29.30	2.00	0.26	5.00	0.00	0.04	0.04
29.35	2.00	0.26	5.00	0.00	0.04	0.04
29.40	2.00	0.26	5.00	0.00	0.04	0.04
29.45	2.00	0.26	5.00	0.00	0.04	0.04
29.50	2.00	0.26	5.00	0.00	0.04	0.04
29.55	2.00	0.26	5.00	0.00	0.04	0.04
29.60	2.00	0.26	5.00	0.00	0.04	0.04
29.65	2.00	0.26	5.00	0.00	0.04	0.04
29.70	2.00	0.26	5.00	0.00	0.04	0.04
29.75	2.00	0.26	5.00	0.00	0.04	0.04
29.80	2.00	0.26	5.00	0.00	0.04	0.04
29.85	2.00	0.26	5.00	0.00	0.04	0.04
29.90	2.00	0.26	5.00	0.00	0.04	0.04
29.95	2.00	0.26	5.00	0.00	0.04	0.04
30.00	2.00	0.26	5.00	0.00	0.04	0.04
30.05	2.00	0.26	5.00	0.00	0.04	0.04
30.10	2.00	0.26	5.00	0.00	0.04	0.04
30.15	2.00	0.26	5.00	0.00	0.04	0.04
30.20	2.00	0.26	5.00	0.00	0.04	0.04
30.25	2.00	0.26	5.00	0.00	0.04	0.04
30.30	2.00	0.26	5.00	0.00	0.04	0.04
30.35	2.00	0.26	5.00	0.00	0.04	0.04
30.40	2.00	0.26	5.00	0.00	0.04	0.04
30.45	2.00	0.26	5.00	0.00	0.04	0.04
30.50	2.00	0.26	5.00	0.00	0.04	0.04
30.55	2.00	0.26	5.00	0.00	0.04	0.04
30.60	2.00	0.26	5.00	0.00	0.04	0.04
30.65	2.00	0.26	5.00	0.00	0.04	0.04
30.70	2.00	0.26	5.00	0.00	0.04	0.04
30.75	2.00	0.26	5.00	0.00	0.04	0.04
30.80	2.00	0.26	5.00	0.00	0.04	0.04
30.85	2.00	0.26	5.00	0.00	0.04	0.04
30.90	2.00	0.25	5.00	0.00	0.04	0.04
30.95	2.00	0.25	5.00	0.00	0.04	0.04
31.00	2.00	0.25	5.00	0.00	0.04	0.04

31.05	0.68	0.25	5.00	0.00	0.04	0.04
31.10	0.68	0.25	5.00	0.00	0.04	0.04
31.15	0.68	0.25	5.00	0.00	0.04	0.04
31.20	0.68	0.25	5.00	0.00	0.04	0.04
31.25	0.68	0.25	5.00	0.00	0.04	0.04
31.30	0.68	0.25	5.00	0.00	0.04	0.04
31.35	0.68	0.25	5.00	0.00	0.04	0.04
31.40	0.68	0.25	5.00	0.00	0.04	0.04
31.45	0.68	0.25	5.00	0.00	0.03	0.03
31.50	0.68	0.25	5.00	0.00	0.03	0.03
31.55	0.68	0.25	5.00	0.00	0.03	0.03
31.60	0.68	0.25	5.00	0.00	0.03	0.03
31.65	0.68	0.25	5.00	0.00	0.03	0.03
31.70	0.68	0.25	5.00	0.00	0.03	0.03
31.75	0.68	0.25	5.00	0.00	0.03	0.03
31.80	0.68	0.25	5.00	0.00	0.03	0.03
31.85	0.68	0.25	5.00	0.00	0.03	0.03
31.90	0.68	0.25	5.00	0.00	0.03	0.03
31.95	0.68	0.25	5.00	0.00	0.03	0.03
32.00	0.68	0.25	5.00	0.00	0.03	0.03
32.05	0.68	0.25	5.00	0.00	0.03	0.03
32.10	0.68	0.25	5.00	0.00	0.03	0.03
32.15	0.68	0.25	5.00	0.00	0.03	0.03
32.20	0.68	0.25	5.00	0.00	0.03	0.03
32.25	0.68	0.25	5.00	0.00	0.03	0.03
32.30	0.68	0.25	5.00	0.00	0.03	0.03
32.35	0.68	0.25	5.00	0.00	0.03	0.03
32.40	0.67	0.25	5.00	0.00	0.03	0.03
32.45	0.67	0.25	5.00	0.00	0.03	0.03
32.50	0.67	0.25	5.00	0.00	0.03	0.03
32.55	0.67	0.25	5.00	0.00	0.03	0.03
32.60	0.67	0.25	5.00	0.00	0.03	0.03
32.65	0.67	0.25	5.00	0.00	0.03	0.03
32.70	0.67	0.25	5.00	0.00	0.03	0.03
32.75	0.67	0.25	5.00	0.00	0.03	0.03
32.80	0.67	0.25	5.00	0.00	0.03	0.03
32.85	0.67	0.25	5.00	0.00	0.03	0.03
32.90	0.67	0.25	5.00	0.00	0.03	0.03
32.95	0.67	0.25	5.00	0.00	0.03	0.03
33.00	0.67	0.25	5.00	0.00	0.03	0.03
33.05	0.67	0.25	5.00	0.00	0.03	0.03
33.10	0.67	0.25	5.00	0.00	0.03	0.03
33.15	0.67	0.25	5.00	0.00	0.03	0.03
33.20	0.67	0.25	5.00	0.00	0.03	0.03
33.25	0.67	0.25	5.00	0.00	0.03	0.03
33.30	0.67	0.25	5.00	0.00	0.03	0.03
33.35	0.67	0.25	5.00	0.00	0.03	0.03
33.40	0.67	0.25	5.00	0.00	0.03	0.03
33.45	0.66	0.25	5.00	0.00	0.02	0.02
33.50	0.60	0.25	5.00	0.00	0.02	0.02
33.55	0.57	0.25	5.00	0.00	0.02	0.02
33.60	0.55	0.25	5.00	0.00	0.02	0.02
33.65	0.53	0.25	5.00	0.00	0.02	0.02
33.70	0.52	0.25	5.00	0.00	0.02	0.02

33.75	0.51	0.25	5.00	0.00	0.02	0.02
33.80	0.50	0.25	5.00	0.00	0.02	0.02
33.85	0.49	0.25	5.00	0.00	0.02	0.02
33.90	0.48	0.25	5.00	0.00	0.02	0.02
33.95	0.48	0.25	5.00	0.00	0.02	0.02
34.00	0.47	0.25	5.00	0.00	0.02	0.02
34.05	0.46	0.25	5.00	0.00	0.02	0.02
34.10	0.46	0.25	5.00	0.00	0.02	0.02
34.15	0.45	0.25	5.00	0.00	0.02	0.02
34.20	0.45	0.25	5.00	0.00	0.02	0.02
34.25	0.44	0.25	5.00	0.00	0.02	0.02
34.30	0.44	0.25	5.00	0.00	0.02	0.02
34.35	0.43	0.25	5.00	0.00	0.02	0.02
34.40	0.43	0.25	5.00	0.00	0.02	0.02
34.45	0.42	0.25	5.00	0.00	0.02	0.02
34.50	0.42	0.25	5.00	0.00	0.02	0.02
34.55	0.41	0.25	5.00	0.00	0.02	0.02
34.60	0.41	0.25	5.00	0.00	0.02	0.02
34.65	0.40	0.25	5.00	0.00	0.02	0.02
34.70	0.40	0.25	5.00	0.00	0.01	0.01
34.75	0.40	0.25	5.00	0.00	0.01	0.01
34.80	0.39	0.25	5.00	0.00	0.01	0.01
34.85	0.39	0.25	5.00	0.00	0.01	0.01
34.90	0.38	0.25	5.00	0.00	0.01	0.01
34.95	0.38	0.25	5.00	0.00	0.01	0.01
35.00	0.38	0.25	5.00	0.00	0.01	0.01
35.05	0.37	0.25	5.00	0.00	0.01	0.01
35.10	0.37	0.25	5.00	0.00	0.01	0.01
35.15	0.37	0.25	5.00	0.00	0.01	0.01
35.20	0.36	0.25	5.00	0.00	0.01	0.01
35.25	0.36	0.25	5.00	0.00	0.01	0.01
35.30	0.36	0.25	5.00	0.00	0.01	0.01
35.35	0.35	0.24	5.00	0.00	0.01	0.01
35.40	0.35	0.24	5.00	0.00	0.01	0.01
35.45	0.35	0.24	5.00	0.00	0.01	0.01
35.50	0.34	0.24	5.00	0.00	0.01	0.01
35.55	0.34	0.24	5.00	0.00	0.01	0.01
35.60	0.34	0.24	5.00	0.00	0.01	0.01
35.65	0.33	0.24	5.00	0.00	0.01	0.01
35.70	0.33	0.24	5.00	0.00	0.00	0.00
35.75	0.33	0.24	5.00	0.00	0.00	0.00
35.80	0.33	0.24	5.00	0.00	0.00	0.00
35.85	0.32	0.24	5.00	0.00	0.00	0.00
35.90	0.32	0.24	5.00	0.00	0.00	0.00
35.95	0.32	0.24	5.00	0.00	0.00	0.00
36.00	0.31	0.24	5.00	0.00	0.00	0.00
36.05	0.32	0.24	1.30	0.00	0.00	0.00
36.10	0.32	0.24	1.31	0.00	0.00	0.00
36.15	0.32	0.24	1.31	0.00	0.00	0.00
36.20	0.32	0.24	1.32	0.00	0.00	0.00
36.25	0.32	0.24	1.33	0.00	0.00	0.00
36.30	0.33	0.24	1.34	0.00	0.00	0.00
36.35	0.33	0.24	1.34	0.00	0.00	0.00
36.40	0.33	0.24	1.35	0.00	0.00	0.00

36.45	0.33	0.24	1.36	0.00	0.00	0.00
36.50	0.33	0.24	1.37	0.00	0.00	0.00
36.55	0.34	0.24	1.38	0.00	0.00	0.00
36.60	0.34	0.24	1.38	0.00	0.00	0.00
36.65	0.34	0.24	1.39	0.00	0.00	0.00
36.70	0.34	0.24	1.40	0.00	0.00	0.00
36.75	0.34	0.24	1.41	0.00	0.00	0.00
36.80	0.35	0.24	1.42	0.00	0.00	0.00
36.85	0.35	0.24	1.42	0.00	0.00	0.00
36.90	0.35	0.24	1.43	0.00	0.00	0.00
36.95	0.35	0.24	1.44	0.00	0.00	0.00
37.00	0.35	0.24	1.45	0.00	0.00	0.00
37.05	0.36	0.24	1.46	0.00	0.00	0.00
37.10	0.36	0.24	1.47	0.00	0.00	0.00
37.15	0.36	0.24	1.48	0.00	0.00	0.00
37.20	0.36	0.24	1.48	0.00	0.00	0.00
37.25	0.37	0.24	1.49	0.00	0.00	0.00
37.30	0.37	0.24	1.50	0.00	0.00	0.00
37.35	0.37	0.24	1.51	0.00	0.00	0.00
37.40	0.37	0.24	1.52	0.00	0.00	0.00
37.45	0.37	0.24	1.53	0.00	0.00	0.00
37.50	0.38	0.25	1.54	0.00	0.00	0.00
37.55	0.38	0.25	1.55	0.00	0.00	0.00
37.60	0.38	0.25	1.56	0.00	0.00	0.00
37.65	0.38	0.25	1.57	0.00	0.00	0.00
37.70	0.39	0.25	1.58	0.00	0.00	0.00
37.75	0.39	0.25	1.59	0.00	0.00	0.00
37.80	0.39	0.25	1.60	0.00	0.00	0.00
37.85	0.39	0.25	1.61	0.00	0.00	0.00
37.90	0.40	0.25	1.62	0.00	0.00	0.00
37.95	0.40	0.25	1.63	0.00	0.00	0.00
38.00	0.40	0.25	1.64	0.00	0.00	0.00
38.05	0.41	0.25	1.65	0.00	0.00	0.00
38.10	0.41	0.25	1.66	0.00	0.00	0.00
38.15	0.41	0.25	1.67	0.00	0.00	0.00
38.20	0.41	0.25	1.68	0.00	0.00	0.00
38.25	0.42	0.25	1.70	0.00	0.00	0.00
38.30	0.42	0.25	1.71	0.00	0.00	0.00
38.35	0.42	0.25	1.72	0.00	0.00	0.00
38.40	0.43	0.25	1.73	0.00	0.00	0.00
38.45	0.43	0.25	1.75	0.00	0.00	0.00
38.50	0.43	0.25	1.76	0.00	0.00	0.00
38.55	0.44	0.25	1.77	0.00	0.00	0.00
38.60	0.44	0.25	1.79	0.00	0.00	0.00
38.65	0.44	0.25	1.80	0.00	0.00	0.00
38.70	0.45	0.25	1.81	0.00	0.00	0.00
38.75	0.45	0.25	1.83	0.00	0.00	0.00
38.80	0.45	0.25	1.84	0.00	0.00	0.00
38.85	0.46	0.25	1.86	0.00	0.00	0.00
38.90	0.46	0.25	1.87	0.00	0.00	0.00
38.95	0.47	0.25	1.89	0.00	0.00	0.00
39.00	0.47	0.25	1.91	0.00	0.00	0.00
39.05	0.48	0.25	1.93	0.00	0.00	0.00
39.10	0.48	0.25	1.95	0.00	0.00	0.00

39.15	0.49	0.25	1.97	0.00	0.00	0.00
39.20	0.49	0.25	1.99	0.00	0.00	0.00
39.25	0.50	0.25	2.01	0.00	0.00	0.00
39.30	0.50	0.25	2.04	0.00	0.00	0.00
39.35	0.51	0.25	2.07	0.00	0.00	0.00
39.40	0.52	0.25	2.10	0.00	0.00	0.00
39.45	0.53	0.25	2.13	0.00	0.00	0.00
39.50	0.54	0.25	2.17	0.00	0.00	0.00
39.55	0.55	0.25	2.23	0.00	0.00	0.00
39.60	0.57	0.25	2.29	0.00	0.00	0.00
39.65	0.59	0.25	2.38	0.00	0.00	0.00
39.70	0.62	0.25	2.52	0.00	0.00	0.00
39.75	0.66	0.25	2.65	0.00	0.00	0.00
39.80	0.66	0.25	2.65	0.00	0.00	0.00
39.85	0.66	0.25	2.65	0.00	0.00	0.00
39.90	0.66	0.25	2.65	0.00	0.00	0.00
39.95	0.66	0.25	2.65	0.00	0.00	0.00
40.00	0.66	0.25	2.65	0.00	0.00	0.00
40.05	0.66	0.25	2.65	0.00	0.00	0.00
40.10	0.66	0.25	2.65	0.00	0.00	0.00
40.15	0.65	0.25	2.65	0.00	0.00	0.00
40.20	0.65	0.25	2.65	0.00	0.00	0.00
40.25	0.65	0.25	2.65	0.00	0.00	0.00
40.30	0.65	0.25	2.65	0.00	0.00	0.00
40.35	0.65	0.25	2.64	0.00	0.00	0.00
40.40	0.65	0.25	2.64	0.00	0.00	0.00
40.45	0.65	0.25	2.64	0.00	0.00	0.00
40.50	0.65	0.25	2.64	0.00	0.00	0.00
40.55	0.65	0.25	2.64	0.00	0.00	0.00
40.60	0.65	0.25	2.64	0.00	0.00	0.00
40.65	0.65	0.25	2.64	0.00	0.00	0.00
40.70	0.65	0.25	2.64	0.00	0.00	0.00
40.75	0.65	0.25	2.64	0.00	0.00	0.00
40.80	0.65	0.25	2.64	0.00	0.00	0.00
40.85	0.65	0.25	2.64	0.00	0.00	0.00
40.90	0.65	0.25	2.64	0.00	0.00	0.00
40.95	0.65	0.25	2.64	0.00	0.00	0.00
41.00	0.65	0.25	2.64	0.00	0.00	0.00
41.05	0.65	0.25	2.64	0.00	0.00	0.00
41.10	0.65	0.25	2.63	0.00	0.00	0.00
41.15	0.65	0.25	2.63	0.00	0.00	0.00
41.20	0.65	0.25	2.63	0.00	0.00	0.00
41.25	0.65	0.25	2.63	0.00	0.00	0.00
41.30	0.65	0.25	2.63	0.00	0.00	0.00
41.35	0.65	0.25	2.63	0.00	0.00	0.00
41.40	0.65	0.25	2.63	0.00	0.00	0.00
41.45	0.65	0.25	2.63	0.00	0.00	0.00
41.50	0.65	0.25	2.63	0.00	0.00	0.00
41.55	0.65	0.25	2.63	0.00	0.00	0.00
41.60	0.65	0.25	2.63	0.00	0.00	0.00
41.65	0.65	0.25	2.63	0.00	0.00	0.00
41.70	0.65	0.25	2.63	0.00	0.00	0.00
41.75	0.65	0.25	2.63	0.00	0.00	0.00
41.80	0.65	0.25	2.63	0.00	0.00	0.00

41.85	0.65	0.25	2.63	0.00	0.00	0.00
41.90	0.65	0.25	2.62	0.00	0.00	0.00
41.95	0.65	0.25	2.62	0.00	0.00	0.00
42.00	0.65	0.25	2.62	0.00	0.00	0.00
42.05	0.65	0.25	2.62	0.00	0.00	0.00
42.10	0.65	0.25	2.62	0.00	0.00	0.00
42.15	0.65	0.25	2.62	0.00	0.00	0.00
42.20	0.65	0.25	2.62	0.00	0.00	0.00
42.25	0.65	0.25	2.62	0.00	0.00	0.00
42.30	0.65	0.25	2.62	0.00	0.00	0.00
42.35	0.65	0.25	2.62	0.00	0.00	0.00
42.40	0.65	0.25	2.62	0.00	0.00	0.00
42.45	0.65	0.25	2.62	0.00	0.00	0.00
42.50	0.65	0.25	2.62	0.00	0.00	0.00
42.55	0.65	0.25	2.62	0.00	0.00	0.00
42.60	0.65	0.25	2.62	0.00	0.00	0.00
42.65	0.65	0.25	2.62	0.00	0.00	0.00
42.70	0.65	0.25	2.62	0.00	0.00	0.00
42.75	0.65	0.25	2.62	0.00	0.00	0.00
42.80	0.65	0.25	2.61	0.00	0.00	0.00
42.85	0.65	0.25	2.61	0.00	0.00	0.00
42.90	0.65	0.25	2.61	0.00	0.00	0.00
42.95	0.65	0.25	2.61	0.00	0.00	0.00
43.00	0.65	0.25	2.61	0.00	0.00	0.00
43.05	0.65	0.25	2.61	0.00	0.00	0.00
43.10	0.65	0.25	2.61	0.00	0.00	0.00
43.15	0.65	0.25	2.61	0.00	0.00	0.00
43.20	0.65	0.25	2.61	0.00	0.00	0.00
43.25	0.65	0.25	2.61	0.00	0.00	0.00
43.30	0.65	0.25	2.61	0.00	0.00	0.00
43.35	0.65	0.25	2.61	0.00	0.00	0.00
43.40	0.65	0.25	2.61	0.00	0.00	0.00
43.45	0.65	0.25	2.61	0.00	0.00	0.00
43.50	0.65	0.25	2.61	0.00	0.00	0.00
43.55	0.65	0.25	2.61	0.00	0.00	0.00
43.60	0.65	0.25	2.61	0.00	0.00	0.00
43.65	0.65	0.25	2.61	0.00	0.00	0.00
43.70	0.65	0.25	2.61	0.00	0.00	0.00
43.75	0.65	0.25	2.61	0.00	0.00	0.00
43.80	0.65	0.25	2.61	0.00	0.00	0.00
43.85	0.65	0.25	2.60	0.00	0.00	0.00
43.90	0.65	0.25	2.60	0.00	0.00	0.00
43.95	0.65	0.25	2.60	0.00	0.00	0.00
44.00	0.65	0.25	2.60	0.00	0.00	0.00
44.05	0.65	0.25	2.60	0.00	0.00	0.00
44.10	0.65	0.25	2.60	0.00	0.00	0.00
44.15	0.65	0.25	2.60	0.00	0.00	0.00
44.20	0.65	0.25	2.60	0.00	0.00	0.00
44.25	0.65	0.25	2.60	0.00	0.00	0.00
44.30	0.65	0.25	2.60	0.00	0.00	0.00
44.35	0.65	0.25	2.60	0.00	0.00	0.00
44.40	0.65	0.25	2.60	0.00	0.00	0.00
44.45	0.65	0.25	2.60	0.00	0.00	0.00
44.50	0.65	0.25	2.60	0.00	0.00	0.00

44.55	0.65	0.25	2.60	0.00	0.00	0.00
44.60	0.65	0.25	2.60	0.00	0.00	0.00
44.65	0.65	0.25	2.60	0.00	0.00	0.00
44.70	0.65	0.25	2.60	0.00	0.00	0.00
44.75	0.65	0.25	2.60	0.00	0.00	0.00
44.80	0.65	0.25	2.60	0.00	0.00	0.00
44.85	0.65	0.25	2.60	0.00	0.00	0.00
44.90	0.65	0.25	2.60	0.00	0.00	0.00
44.95	0.65	0.25	2.60	0.00	0.00	0.00
45.00	0.65	0.25	2.59	0.00	0.00	0.00
45.05	0.65	0.25	2.59	0.00	0.00	0.00
45.10	0.65	0.25	2.59	0.00	0.00	0.00
45.15	0.65	0.25	2.59	0.00	0.00	0.00
45.20	0.65	0.25	2.59	0.00	0.00	0.00
45.25	0.65	0.25	2.59	0.00	0.00	0.00
45.30	0.65	0.25	2.59	0.00	0.00	0.00
45.35	0.65	0.25	2.59	0.00	0.00	0.00
45.40	0.65	0.25	2.59	0.00	0.00	0.00
45.45	0.65	0.25	2.59	0.00	0.00	0.00
45.50	0.65	0.25	2.59	0.00	0.00	0.00
45.55	0.65	0.25	2.59	0.00	0.00	0.00
45.60	0.65	0.25	2.59	0.00	0.00	0.00
45.65	0.65	0.25	2.59	0.00	0.00	0.00
45.70	0.65	0.25	2.59	0.00	0.00	0.00
45.75	0.65	0.25	2.59	0.00	0.00	0.00
45.80	0.65	0.25	2.59	0.00	0.00	0.00
45.85	0.65	0.25	2.59	0.00	0.00	0.00
45.90	0.64	0.25	2.59	0.00	0.00	0.00
45.95	0.64	0.25	2.59	0.00	0.00	0.00
46.00	0.64	0.25	2.59	0.00	0.00	0.00
46.05	0.64	0.25	2.59	0.00	0.00	0.00
46.10	0.64	0.25	2.59	0.00	0.00	0.00
46.15	0.64	0.25	2.59	0.00	0.00	0.00
46.20	0.64	0.25	2.59	0.00	0.00	0.00
46.25	0.64	0.25	2.59	0.00	0.00	0.00
46.30	0.64	0.25	2.59	0.00	0.00	0.00
46.35	0.64	0.25	2.59	0.00	0.00	0.00
46.40	0.64	0.25	2.59	0.00	0.00	0.00
46.45	0.64	0.25	2.59	0.00	0.00	0.00
46.50	0.64	0.25	2.58	0.00	0.00	0.00
46.55	0.64	0.25	2.58	0.00	0.00	0.00
46.60	0.64	0.25	2.58	0.00	0.00	0.00
46.65	0.64	0.25	2.58	0.00	0.00	0.00
46.70	0.64	0.25	2.58	0.00	0.00	0.00
46.75	0.64	0.25	2.58	0.00	0.00	0.00
46.80	0.64	0.25	2.58	0.00	0.00	0.00
46.85	0.64	0.25	2.58	0.00	0.00	0.00
46.90	0.64	0.25	2.58	0.00	0.00	0.00
46.95	0.64	0.25	2.58	0.00	0.00	0.00
47.00	0.64	0.25	2.58	0.00	0.00	0.00
47.05	0.64	0.25	2.58	0.00	0.00	0.00
47.10	0.64	0.25	2.58	0.00	0.00	0.00
47.15	0.64	0.25	2.58	0.00	0.00	0.00
47.20	0.64	0.25	2.58	0.00	0.00	0.00

47.25	0.64	0.25	2.58	0.00	0.00	0.00
47.30	0.64	0.25	2.58	0.00	0.00	0.00
47.35	0.64	0.25	2.58	0.00	0.00	0.00
47.40	0.64	0.25	2.58	0.00	0.00	0.00
47.45	0.64	0.25	2.58	0.00	0.00	0.00
47.50	0.64	0.25	2.58	0.00	0.00	0.00
47.55	0.64	0.25	2.58	0.00	0.00	0.00
47.60	0.64	0.25	2.58	0.00	0.00	0.00
47.65	0.64	0.25	2.58	0.00	0.00	0.00
47.70	0.64	0.25	2.58	0.00	0.00	0.00
47.75	0.64	0.25	2.58	0.00	0.00	0.00
47.80	0.64	0.25	2.58	0.00	0.00	0.00
47.85	0.64	0.25	2.58	0.00	0.00	0.00
47.90	0.64	0.25	2.58	0.00	0.00	0.00
47.95	0.64	0.25	2.58	0.00	0.00	0.00
48.00	0.64	0.25	2.58	0.00	0.00	0.00
48.05	0.64	0.25	2.58	0.00	0.00	0.00
48.10	0.64	0.25	2.58	0.00	0.00	0.00
48.15	0.64	0.25	2.58	0.00	0.00	0.00
48.20	0.64	0.25	2.58	0.00	0.00	0.00
48.25	0.64	0.25	2.58	0.00	0.00	0.00
48.30	0.64	0.25	2.58	0.00	0.00	0.00
48.35	0.64	0.25	2.58	0.00	0.00	0.00
48.40	0.64	0.25	2.58	0.00	0.00	0.00
48.45	0.64	0.25	2.58	0.00	0.00	0.00
48.50	0.64	0.25	2.58	0.00	0.00	0.00
48.55	0.64	0.25	2.58	0.00	0.00	0.00
48.60	0.64	0.25	2.57	0.00	0.00	0.00
48.65	0.64	0.25	2.57	0.00	0.00	0.00
48.70	0.64	0.25	2.57	0.00	0.00	0.00
48.75	0.64	0.25	2.57	0.00	0.00	0.00
48.80	0.64	0.25	2.57	0.00	0.00	0.00
48.85	0.64	0.25	2.57	0.00	0.00	0.00
48.90	0.64	0.25	2.57	0.00	0.00	0.00
48.95	0.64	0.25	2.57	0.00	0.00	0.00
49.00	0.64	0.25	2.57	0.00	0.00	0.00
49.05	0.64	0.25	2.57	0.00	0.00	0.00
49.10	0.64	0.25	2.57	0.00	0.00	0.00
49.15	0.64	0.25	2.57	0.00	0.00	0.00
49.20	0.64	0.25	2.57	0.00	0.00	0.00
49.25	0.64	0.25	2.57	0.00	0.00	0.00
49.30	0.64	0.25	2.57	0.00	0.00	0.00
49.35	0.64	0.25	2.57	0.00	0.00	0.00
49.40	0.64	0.25	2.57	0.00	0.00	0.00
49.45	0.64	0.25	2.57	0.00	0.00	0.00
49.50	0.64	0.25	2.57	0.00	0.00	0.00
49.55	0.64	0.25	2.57	0.00	0.00	0.00
49.60	0.64	0.25	2.57	0.00	0.00	0.00
49.65	0.64	0.25	2.57	0.00	0.00	0.00
49.70	0.64	0.25	2.57	0.00	0.00	0.00
49.75	0.64	0.25	2.57	0.00	0.00	0.00
49.80	0.64	0.25	2.57	0.00	0.00	0.00
49.85	0.64	0.25	2.57	0.00	0.00	0.00
49.90	0.64	0.25	2.57	0.00	0.00	0.00

49.95	0.64	0.25	2.57	0.00	0.00	0.00
50.00	0.64	0.25	2.57	0.00	0.00	0.00
50.05	0.64	0.25	2.57	0.00	0.00	0.00
50.10	0.64	0.25	2.57	0.00	0.00	0.00
50.15	0.64	0.25	2.57	0.00	0.00	0.00
50.20	0.64	0.25	2.57	0.00	0.00	0.00
50.25	0.64	0.25	2.57	0.00	0.00	0.00
50.30	0.64	0.25	2.57	0.00	0.00	0.00
50.35	0.64	0.25	2.57	0.00	0.00	0.00
50.40	0.64	0.25	2.57	0.00	0.00	0.00
50.45	0.64	0.25	2.57	0.00	0.00	0.00
50.50	0.64	0.25	2.57	0.00	0.00	0.00
50.55	0.64	0.25	2.57	0.00	0.00	0.00
50.60	0.64	0.25	2.57	0.00	0.00	0.00
50.65	0.64	0.25	2.57	0.00	0.00	0.00
50.70	0.64	0.25	2.57	0.00	0.00	0.00
50.75	0.64	0.25	2.57	0.00	0.00	0.00
50.80	0.64	0.25	2.57	0.00	0.00	0.00
50.85	0.64	0.25	2.57	0.00	0.00	0.00
50.90	0.64	0.25	2.57	0.00	0.00	0.00
50.95	0.64	0.25	2.57	0.00	0.00	0.00
51.00	0.64	0.25	2.57	0.00	0.00	0.00

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* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm(1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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1 atm(atmosphere) = 1 tsf (ton/ft2)

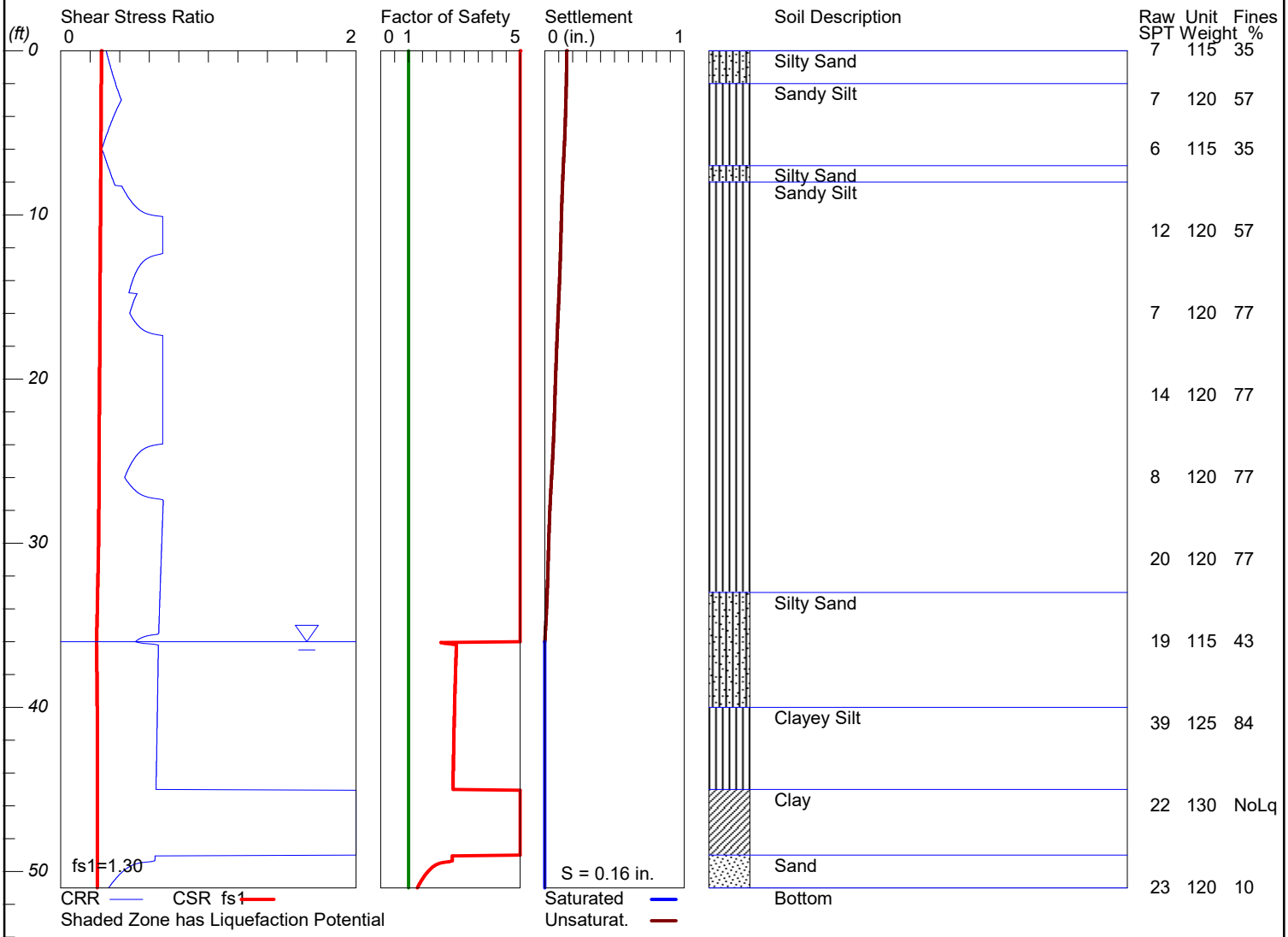
CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

LIQUEFACTION ANALYSIS

19596 COS

Hole No.=B-11 Water Depth=36 ft

Magnitude=6.61
Acceleration=0.327g



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****
LIQUEFACTION ANALYSIS SUMMARY
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Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to SEI, 5/7/2024 5:11:50 PM

Input File Name: O:\b. PROJECT FILES (ACTIVE)\19500-19599\19596 COS, University Center & Student Union Bldgs GEOTECH\OFFICE REPORTS\Liquefypro Files\19596 B-11 Liqufey.liq
Title: 19596 COS
Subtitle: 19596 B-11

Surface Elev.=
Hole No.=B-11
Depth of Hole= 51.00 ft
Water Table during Earthquake= 36.00 ft
Water Table during In-Situ Testing= 36.00 ft
Max. Acceleration= 0.33 g
Earthquake Magnitude= 6.61

Input Data:
Surface Elev.=
Hole No.=B-11
Depth of Hole=51.00 ft
Water Table during Earthquake= 36.00 ft
Water Table during In-Situ Testing= 36.00 ft
Max. Acceleration=0.33 g
Earthquake Magnitude=6.61
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Modify Stark/Olson
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	7.00	115.00	35.00
3.00	7.00	120.00	57.00
6.00	6.00	115.00	35.00
11.00	12.00	120.00	57.00
16.00	7.00	120.00	77.00
21.00	14.00	120.00	77.00
26.00	8.00	120.00	77.00
31.00	20.00	120.00	77.00
36.00	19.00	115.00	43.00
41.00	39.00	125.00	84.00
46.00	22.00	130.00	NoLiq
51.00	23.00	120.00	10.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.16 in.
Total Settlement of Saturated and Unsaturated Sands=0.16 in.
Differential Settlement=0.079 to 0.104 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.31	0.28	5.00	0.00	0.16	0.16
0.05	0.31	0.28	5.00	0.00	0.16	0.16
0.10	0.31	0.28	5.00	0.00	0.16	0.16
0.15	0.31	0.28	5.00	0.00	0.16	0.16
0.20	0.31	0.28	5.00	0.00	0.16	0.16
0.25	0.32	0.28	5.00	0.00	0.16	0.16
0.30	0.32	0.28	5.00	0.00	0.16	0.16
0.35	0.32	0.28	5.00	0.00	0.16	0.16
0.40	0.32	0.28	5.00	0.00	0.16	0.16
0.45	0.32	0.28	5.00	0.00	0.16	0.16
0.50	0.32	0.28	5.00	0.00	0.16	0.16
0.55	0.32	0.28	5.00	0.00	0.16	0.16
0.60	0.33	0.28	5.00	0.00	0.16	0.16
0.65	0.33	0.28	5.00	0.00	0.16	0.16
0.70	0.33	0.28	5.00	0.00	0.16	0.16
0.75	0.33	0.28	5.00	0.00	0.16	0.16
0.80	0.33	0.28	5.00	0.00	0.16	0.16
0.85	0.33	0.28	5.00	0.00	0.16	0.16
0.90	0.33	0.28	5.00	0.00	0.16	0.16
0.95	0.34	0.28	5.00	0.00	0.16	0.16
1.00	0.34	0.28	5.00	0.00	0.16	0.16
1.05	0.34	0.28	5.00	0.00	0.16	0.16
1.10	0.34	0.28	5.00	0.00	0.16	0.16
1.15	0.34	0.28	5.00	0.00	0.16	0.16
1.20	0.34	0.28	5.00	0.00	0.16	0.16
1.25	0.35	0.28	5.00	0.00	0.16	0.16
1.30	0.35	0.28	5.00	0.00	0.16	0.16

1.35	0.35	0.28	5.00	0.00	0.16	0.16
1.40	0.35	0.28	5.00	0.00	0.16	0.16
1.45	0.35	0.28	5.00	0.00	0.16	0.16
1.50	0.35	0.28	5.00	0.00	0.16	0.16
1.55	0.36	0.28	5.00	0.00	0.16	0.16
1.60	0.36	0.28	5.00	0.00	0.16	0.16
1.65	0.36	0.28	5.00	0.00	0.16	0.16
1.70	0.36	0.28	5.00	0.00	0.16	0.16
1.75	0.36	0.28	5.00	0.00	0.15	0.15
1.80	0.36	0.28	5.00	0.00	0.15	0.15
1.85	0.37	0.28	5.00	0.00	0.15	0.15
1.90	0.37	0.28	5.00	0.00	0.15	0.15
1.95	0.37	0.28	5.00	0.00	0.15	0.15
2.00	0.37	0.28	5.00	0.00	0.15	0.15
2.05	0.37	0.27	5.00	0.00	0.15	0.15
2.10	0.37	0.27	5.00	0.00	0.15	0.15
2.15	0.38	0.27	5.00	0.00	0.15	0.15
2.20	0.38	0.27	5.00	0.00	0.15	0.15
2.25	0.38	0.27	5.00	0.00	0.15	0.15
2.30	0.38	0.27	5.00	0.00	0.15	0.15
2.35	0.38	0.27	5.00	0.00	0.15	0.15
2.40	0.39	0.27	5.00	0.00	0.15	0.15
2.45	0.39	0.27	5.00	0.00	0.15	0.15
2.50	0.39	0.27	5.00	0.00	0.15	0.15
2.55	0.39	0.27	5.00	0.00	0.15	0.15
2.60	0.39	0.27	5.00	0.00	0.15	0.15
2.65	0.40	0.27	5.00	0.00	0.15	0.15
2.70	0.40	0.27	5.00	0.00	0.15	0.15
2.75	0.40	0.27	5.00	0.00	0.15	0.15
2.80	0.40	0.27	5.00	0.00	0.15	0.15
2.85	0.40	0.27	5.00	0.00	0.15	0.15
2.90	0.41	0.27	5.00	0.00	0.15	0.15
2.95	0.41	0.27	5.00	0.00	0.15	0.15
3.00	0.41	0.27	5.00	0.00	0.15	0.15
3.05	0.41	0.27	5.00	0.00	0.15	0.15
3.10	0.40	0.27	5.00	0.00	0.15	0.15
3.15	0.40	0.27	5.00	0.00	0.15	0.15
3.20	0.40	0.27	5.00	0.00	0.15	0.15
3.25	0.40	0.27	5.00	0.00	0.15	0.15
3.30	0.39	0.27	5.00	0.00	0.15	0.15
3.35	0.39	0.27	5.00	0.00	0.15	0.15
3.40	0.39	0.27	5.00	0.00	0.15	0.15
3.45	0.39	0.27	5.00	0.00	0.15	0.15
3.50	0.38	0.27	5.00	0.00	0.15	0.15
3.55	0.38	0.27	5.00	0.00	0.15	0.15
3.60	0.38	0.27	5.00	0.00	0.15	0.15
3.65	0.38	0.27	5.00	0.00	0.15	0.15
3.70	0.37	0.27	5.00	0.00	0.15	0.15
3.75	0.37	0.27	5.00	0.00	0.15	0.15
3.80	0.37	0.27	5.00	0.00	0.15	0.15
3.85	0.37	0.27	5.00	0.00	0.15	0.15
3.90	0.36	0.27	5.00	0.00	0.15	0.15
3.95	0.36	0.27	5.00	0.00	0.15	0.15
4.00	0.36	0.27	5.00	0.00	0.15	0.15

4.05	0.36	0.27	5.00	0.00	0.15	0.15
4.10	0.35	0.27	5.00	0.00	0.15	0.15
4.15	0.35	0.27	5.00	0.00	0.15	0.15
4.20	0.35	0.27	5.00	0.00	0.15	0.15
4.25	0.35	0.27	5.00	0.00	0.15	0.15
4.30	0.35	0.27	5.00	0.00	0.15	0.15
4.35	0.34	0.27	5.00	0.00	0.15	0.15
4.40	0.34	0.27	5.00	0.00	0.15	0.15
4.45	0.34	0.27	5.00	0.00	0.15	0.15
4.50	0.34	0.27	5.00	0.00	0.15	0.15
4.55	0.33	0.27	5.00	0.00	0.15	0.15
4.60	0.33	0.27	5.00	0.00	0.15	0.15
4.65	0.33	0.27	5.00	0.00	0.15	0.15
4.70	0.33	0.27	5.00	0.00	0.15	0.15
4.75	0.33	0.27	5.00	0.00	0.15	0.15
4.80	0.32	0.27	5.00	0.00	0.15	0.15
4.85	0.32	0.27	5.00	0.00	0.15	0.15
4.90	0.32	0.27	5.00	0.00	0.14	0.14
4.95	0.32	0.27	5.00	0.00	0.14	0.14
5.00	0.32	0.27	5.00	0.00	0.14	0.14
5.05	0.31	0.27	5.00	0.00	0.14	0.14
5.10	0.31	0.27	5.00	0.00	0.14	0.14
5.15	0.31	0.27	5.00	0.00	0.14	0.14
5.20	0.31	0.27	5.00	0.00	0.14	0.14
5.25	0.31	0.27	5.00	0.00	0.14	0.14
5.30	0.30	0.27	5.00	0.00	0.14	0.14
5.35	0.30	0.27	5.00	0.00	0.14	0.14
5.40	0.30	0.27	5.00	0.00	0.14	0.14
5.45	0.30	0.27	5.00	0.00	0.14	0.14
5.50	0.30	0.27	5.00	0.00	0.14	0.14
5.55	0.29	0.27	5.00	0.00	0.14	0.14
5.60	0.29	0.27	5.00	0.00	0.14	0.14
5.65	0.29	0.27	5.00	0.00	0.14	0.14
5.70	0.29	0.27	5.00	0.00	0.14	0.14
5.75	0.29	0.27	5.00	0.00	0.14	0.14
5.80	0.29	0.27	5.00	0.00	0.14	0.14
5.85	0.28	0.27	5.00	0.00	0.14	0.14
5.90	0.28	0.27	5.00	0.00	0.14	0.14
5.95	0.28	0.27	5.00	0.00	0.14	0.14
6.00	0.28	0.27	5.00	0.00	0.14	0.14
6.05	0.28	0.27	5.00	0.00	0.14	0.14
6.10	0.28	0.27	5.00	0.00	0.14	0.14
6.15	0.29	0.27	5.00	0.00	0.14	0.14
6.20	0.29	0.27	5.00	0.00	0.14	0.14
6.25	0.29	0.27	5.00	0.00	0.14	0.14
6.30	0.29	0.27	5.00	0.00	0.14	0.14
6.35	0.29	0.27	5.00	0.00	0.14	0.14
6.40	0.30	0.27	5.00	0.00	0.14	0.14
6.45	0.30	0.27	5.00	0.00	0.14	0.14
6.50	0.30	0.27	5.00	0.00	0.14	0.14
6.55	0.30	0.27	5.00	0.00	0.14	0.14
6.60	0.30	0.27	5.00	0.00	0.14	0.14
6.65	0.31	0.27	5.00	0.00	0.14	0.14
6.70	0.31	0.27	5.00	0.00	0.13	0.13

6.75	0.31	0.27	5.00	0.00	0.13	0.13
6.80	0.31	0.27	5.00	0.00	0.13	0.13
6.85	0.31	0.27	5.00	0.00	0.13	0.13
6.90	0.32	0.27	5.00	0.00	0.13	0.13
6.95	0.32	0.27	5.00	0.00	0.13	0.13
7.00	0.32	0.27	5.00	0.00	0.13	0.13
7.05	0.32	0.27	5.00	0.00	0.13	0.13
7.10	0.32	0.27	5.00	0.00	0.13	0.13
7.15	0.32	0.27	5.00	0.00	0.13	0.13
7.20	0.33	0.27	5.00	0.00	0.13	0.13
7.25	0.33	0.27	5.00	0.00	0.13	0.13
7.30	0.33	0.27	5.00	0.00	0.13	0.13
7.35	0.33	0.27	5.00	0.00	0.13	0.13
7.40	0.33	0.27	5.00	0.00	0.13	0.13
7.45	0.34	0.27	5.00	0.00	0.13	0.13
7.50	0.34	0.27	5.00	0.00	0.13	0.13
7.55	0.34	0.27	5.00	0.00	0.13	0.13
7.60	0.34	0.27	5.00	0.00	0.13	0.13
7.65	0.34	0.27	5.00	0.00	0.13	0.13
7.70	0.35	0.27	5.00	0.00	0.13	0.13
7.75	0.35	0.27	5.00	0.00	0.13	0.13
7.80	0.35	0.27	5.00	0.00	0.13	0.13
7.85	0.35	0.27	5.00	0.00	0.13	0.13
7.90	0.36	0.27	5.00	0.00	0.13	0.13
7.95	0.36	0.27	5.00	0.00	0.13	0.13
8.00	0.36	0.27	5.00	0.00	0.13	0.13
8.05	0.36	0.27	5.00	0.00	0.13	0.13
8.10	0.36	0.27	5.00	0.00	0.13	0.13
8.15	0.37	0.27	5.00	0.00	0.13	0.13
8.20	0.37	0.27	5.00	0.00	0.13	0.13
8.25	0.41	0.27	5.00	0.00	0.13	0.13
8.30	0.42	0.27	5.00	0.00	0.13	0.13
8.35	0.42	0.27	5.00	0.00	0.13	0.13
8.40	0.42	0.27	5.00	0.00	0.13	0.13
8.45	0.43	0.27	5.00	0.00	0.13	0.13
8.50	0.43	0.27	5.00	0.00	0.13	0.13
8.55	0.43	0.27	5.00	0.00	0.13	0.13
8.60	0.44	0.27	5.00	0.00	0.13	0.13
8.65	0.44	0.27	5.00	0.00	0.13	0.13
8.70	0.44	0.27	5.00	0.00	0.12	0.12
8.75	0.45	0.27	5.00	0.00	0.12	0.12
8.80	0.45	0.27	5.00	0.00	0.12	0.12
8.85	0.45	0.27	5.00	0.00	0.12	0.12
8.90	0.46	0.27	5.00	0.00	0.12	0.12
8.95	0.46	0.27	5.00	0.00	0.12	0.12
9.00	0.46	0.27	5.00	0.00	0.12	0.12
9.05	0.47	0.27	5.00	0.00	0.12	0.12
9.10	0.47	0.27	5.00	0.00	0.12	0.12
9.15	0.48	0.27	5.00	0.00	0.12	0.12
9.20	0.48	0.27	5.00	0.00	0.12	0.12
9.25	0.48	0.27	5.00	0.00	0.12	0.12
9.30	0.49	0.27	5.00	0.00	0.12	0.12
9.35	0.49	0.27	5.00	0.00	0.12	0.12
9.40	0.50	0.27	5.00	0.00	0.12	0.12

9.45	0.50	0.27	5.00	0.00	0.12	0.12
9.50	0.51	0.27	5.00	0.00	0.12	0.12
9.55	0.51	0.27	5.00	0.00	0.12	0.12
9.60	0.52	0.27	5.00	0.00	0.12	0.12
9.65	0.53	0.27	5.00	0.00	0.12	0.12
9.70	0.53	0.27	5.00	0.00	0.12	0.12
9.75	0.54	0.27	5.00	0.00	0.12	0.12
9.80	0.55	0.27	5.00	0.00	0.12	0.12
9.85	0.56	0.27	5.00	0.00	0.12	0.12
9.90	0.57	0.27	5.00	0.00	0.12	0.12
9.95	0.59	0.27	5.00	0.00	0.12	0.12
10.00	0.61	0.27	5.00	0.00	0.12	0.12
10.05	0.64	0.27	5.00	0.00	0.12	0.12
10.10	0.69	0.27	5.00	0.00	0.12	0.12
10.15	0.69	0.27	5.00	0.00	0.12	0.12
10.20	0.69	0.27	5.00	0.00	0.12	0.12
10.25	0.69	0.27	5.00	0.00	0.12	0.12
10.30	0.69	0.27	5.00	0.00	0.12	0.12
10.35	0.69	0.27	5.00	0.00	0.12	0.12
10.40	0.69	0.27	5.00	0.00	0.12	0.12
10.45	0.69	0.27	5.00	0.00	0.12	0.12
10.50	0.69	0.27	5.00	0.00	0.12	0.12
10.55	0.69	0.27	5.00	0.00	0.12	0.12
10.60	0.69	0.27	5.00	0.00	0.12	0.12
10.65	0.69	0.27	5.00	0.00	0.12	0.12
10.70	0.69	0.27	5.00	0.00	0.12	0.12
10.75	0.69	0.27	5.00	0.00	0.12	0.12
10.80	0.69	0.27	5.00	0.00	0.12	0.12
10.85	0.69	0.27	5.00	0.00	0.12	0.12
10.90	0.69	0.27	5.00	0.00	0.12	0.12
10.95	0.69	0.27	5.00	0.00	0.12	0.12
11.00	0.69	0.27	5.00	0.00	0.12	0.12
11.05	0.69	0.27	5.00	0.00	0.12	0.12
11.10	0.69	0.27	5.00	0.00	0.12	0.12
11.15	0.69	0.27	5.00	0.00	0.12	0.12
11.20	0.69	0.27	5.00	0.00	0.12	0.12
11.25	0.69	0.27	5.00	0.00	0.12	0.12
11.30	0.69	0.27	5.00	0.00	0.12	0.12
11.35	0.69	0.27	5.00	0.00	0.12	0.12
11.40	0.69	0.27	5.00	0.00	0.12	0.12
11.45	0.69	0.27	5.00	0.00	0.12	0.12
11.50	0.69	0.27	5.00	0.00	0.12	0.12
11.55	0.69	0.27	5.00	0.00	0.12	0.12
11.60	0.69	0.27	5.00	0.00	0.12	0.12
11.65	0.69	0.27	5.00	0.00	0.11	0.11
11.70	0.69	0.27	5.00	0.00	0.11	0.11
11.75	0.69	0.27	5.00	0.00	0.11	0.11
11.80	0.69	0.27	5.00	0.00	0.11	0.11
11.85	0.69	0.27	5.00	0.00	0.11	0.11
11.90	0.69	0.27	5.00	0.00	0.11	0.11
11.95	0.69	0.27	5.00	0.00	0.11	0.11
12.00	0.69	0.27	5.00	0.00	0.11	0.11
12.05	0.69	0.27	5.00	0.00	0.11	0.11
12.10	0.69	0.27	5.00	0.00	0.11	0.11

12.15	0.69	0.27	5.00	0.00	0.11	0.11
12.20	0.69	0.27	5.00	0.00	0.11	0.11
12.25	0.69	0.27	5.00	0.00	0.11	0.11
12.30	0.69	0.27	5.00	0.00	0.11	0.11
12.35	0.69	0.27	5.00	0.00	0.11	0.11
12.40	0.67	0.27	5.00	0.00	0.11	0.11
12.45	0.64	0.27	5.00	0.00	0.11	0.11
12.50	0.62	0.27	5.00	0.00	0.11	0.11
12.55	0.61	0.27	5.00	0.00	0.11	0.11
12.60	0.60	0.27	5.00	0.00	0.11	0.11
12.65	0.59	0.27	5.00	0.00	0.11	0.11
12.70	0.58	0.27	5.00	0.00	0.11	0.11
12.75	0.57	0.27	5.00	0.00	0.11	0.11
12.80	0.56	0.27	5.00	0.00	0.11	0.11
12.85	0.56	0.27	5.00	0.00	0.11	0.11
12.90	0.55	0.27	5.00	0.00	0.11	0.11
12.95	0.55	0.27	5.00	0.00	0.11	0.11
13.00	0.54	0.27	5.00	0.00	0.11	0.11
13.05	0.54	0.27	5.00	0.00	0.11	0.11
13.10	0.53	0.27	5.00	0.00	0.11	0.11
13.15	0.53	0.27	5.00	0.00	0.11	0.11
13.20	0.53	0.27	5.00	0.00	0.11	0.11
13.25	0.52	0.27	5.00	0.00	0.11	0.11
13.30	0.52	0.27	5.00	0.00	0.11	0.11
13.35	0.52	0.27	5.00	0.00	0.11	0.11
13.40	0.51	0.27	5.00	0.00	0.11	0.11
13.45	0.51	0.27	5.00	0.00	0.11	0.11
13.50	0.51	0.27	5.00	0.00	0.11	0.11
13.55	0.51	0.27	5.00	0.00	0.11	0.11
13.60	0.50	0.27	5.00	0.00	0.11	0.11
13.65	0.50	0.27	5.00	0.00	0.11	0.11
13.70	0.50	0.27	5.00	0.00	0.11	0.11
13.75	0.50	0.27	5.00	0.00	0.11	0.11
13.80	0.50	0.27	5.00	0.00	0.11	0.11
13.85	0.49	0.27	5.00	0.00	0.11	0.11
13.90	0.49	0.27	5.00	0.00	0.11	0.11
13.95	0.49	0.27	5.00	0.00	0.11	0.11
14.00	0.49	0.27	5.00	0.00	0.11	0.11
14.05	0.49	0.27	5.00	0.00	0.11	0.11
14.10	0.48	0.27	5.00	0.00	0.11	0.11
14.15	0.48	0.27	5.00	0.00	0.11	0.11
14.20	0.48	0.27	5.00	0.00	0.10	0.10
14.25	0.48	0.27	5.00	0.00	0.10	0.10
14.30	0.48	0.27	5.00	0.00	0.10	0.10
14.35	0.47	0.27	5.00	0.00	0.10	0.10
14.40	0.47	0.27	5.00	0.00	0.10	0.10
14.45	0.47	0.27	5.00	0.00	0.10	0.10
14.50	0.47	0.27	5.00	0.00	0.10	0.10
14.55	0.47	0.27	5.00	0.00	0.10	0.10
14.60	0.47	0.27	5.00	0.00	0.10	0.10
14.65	0.47	0.27	5.00	0.00	0.10	0.10
14.70	0.46	0.27	5.00	0.00	0.10	0.10
14.75	0.46	0.27	5.00	0.00	0.10	0.10
14.80	0.52	0.27	5.00	0.00	0.10	0.10

14.85	0.51	0.27	5.00	0.00	0.10	0.10
14.90	0.51	0.27	5.00	0.00	0.10	0.10
14.95	0.51	0.27	5.00	0.00	0.10	0.10
15.00	0.51	0.27	5.00	0.00	0.10	0.10
15.05	0.50	0.27	5.00	0.00	0.10	0.10
15.10	0.50	0.27	5.00	0.00	0.10	0.10
15.15	0.50	0.27	5.00	0.00	0.10	0.10
15.20	0.50	0.27	5.00	0.00	0.10	0.10
15.25	0.49	0.27	5.00	0.00	0.10	0.10
15.30	0.49	0.27	5.00	0.00	0.10	0.10
15.35	0.49	0.27	5.00	0.00	0.10	0.10
15.40	0.49	0.27	5.00	0.00	0.10	0.10
15.45	0.49	0.27	5.00	0.00	0.10	0.10
15.50	0.48	0.27	5.00	0.00	0.10	0.10
15.55	0.48	0.27	5.00	0.00	0.10	0.10
15.60	0.48	0.27	5.00	0.00	0.10	0.10
15.65	0.48	0.27	5.00	0.00	0.10	0.10
15.70	0.48	0.27	5.00	0.00	0.10	0.10
15.75	0.48	0.27	5.00	0.00	0.10	0.10
15.80	0.47	0.27	5.00	0.00	0.10	0.10
15.85	0.47	0.27	5.00	0.00	0.10	0.10
15.90	0.47	0.27	5.00	0.00	0.10	0.10
15.95	0.47	0.27	5.00	0.00	0.10	0.10
16.00	0.47	0.27	5.00	0.00	0.10	0.10
16.05	0.47	0.27	5.00	0.00	0.10	0.10
16.10	0.47	0.27	5.00	0.00	0.10	0.10
16.15	0.48	0.27	5.00	0.00	0.10	0.10
16.20	0.48	0.27	5.00	0.00	0.09	0.09
16.25	0.48	0.27	5.00	0.00	0.09	0.09
16.30	0.49	0.27	5.00	0.00	0.09	0.09
16.35	0.49	0.27	5.00	0.00	0.09	0.09
16.40	0.49	0.27	5.00	0.00	0.09	0.09
16.45	0.50	0.27	5.00	0.00	0.09	0.09
16.50	0.50	0.27	5.00	0.00	0.09	0.09
16.55	0.51	0.27	5.00	0.00	0.09	0.09
16.60	0.51	0.27	5.00	0.00	0.09	0.09
16.65	0.52	0.27	5.00	0.00	0.09	0.09
16.70	0.52	0.27	5.00	0.00	0.09	0.09
16.75	0.53	0.27	5.00	0.00	0.09	0.09
16.80	0.53	0.27	5.00	0.00	0.09	0.09
16.85	0.54	0.27	5.00	0.00	0.09	0.09
16.90	0.54	0.27	5.00	0.00	0.09	0.09
16.95	0.55	0.27	5.00	0.00	0.09	0.09
17.00	0.56	0.27	5.00	0.00	0.09	0.09
17.05	0.57	0.27	5.00	0.00	0.09	0.09
17.10	0.58	0.27	5.00	0.00	0.09	0.09
17.15	0.59	0.27	5.00	0.00	0.09	0.09
17.20	0.61	0.27	5.00	0.00	0.09	0.09
17.25	0.63	0.27	5.00	0.00	0.09	0.09
17.30	0.65	0.27	5.00	0.00	0.09	0.09
17.35	0.69	0.27	5.00	0.00	0.09	0.09
17.40	0.69	0.27	5.00	0.00	0.09	0.09
17.45	0.69	0.27	5.00	0.00	0.09	0.09
17.50	0.69	0.27	5.00	0.00	0.09	0.09

17.55	0.69	0.27	5.00	0.00	0.09	0.09
17.60	0.69	0.26	5.00	0.00	0.09	0.09
17.65	0.69	0.26	5.00	0.00	0.09	0.09
17.70	0.69	0.26	5.00	0.00	0.09	0.09
17.75	0.69	0.26	5.00	0.00	0.09	0.09
17.80	0.69	0.26	5.00	0.00	0.09	0.09
17.85	0.69	0.26	5.00	0.00	0.09	0.09
17.90	0.69	0.26	5.00	0.00	0.09	0.09
17.95	0.69	0.26	5.00	0.00	0.09	0.09
18.00	0.69	0.26	5.00	0.00	0.09	0.09
18.05	0.69	0.26	5.00	0.00	0.09	0.09
18.10	0.69	0.26	5.00	0.00	0.09	0.09
18.15	0.69	0.26	5.00	0.00	0.09	0.09
18.20	0.69	0.26	5.00	0.00	0.09	0.09
18.25	0.69	0.26	5.00	0.00	0.08	0.08
18.30	0.69	0.26	5.00	0.00	0.08	0.08
18.35	0.69	0.26	5.00	0.00	0.08	0.08
18.40	0.69	0.26	5.00	0.00	0.08	0.08
18.45	0.69	0.26	5.00	0.00	0.08	0.08
18.50	0.69	0.26	5.00	0.00	0.08	0.08
18.55	0.69	0.26	5.00	0.00	0.08	0.08
18.60	0.69	0.26	5.00	0.00	0.08	0.08
18.65	0.69	0.26	5.00	0.00	0.08	0.08
18.70	0.69	0.26	5.00	0.00	0.08	0.08
18.75	0.69	0.26	5.00	0.00	0.08	0.08
18.80	0.69	0.26	5.00	0.00	0.08	0.08
18.85	0.69	0.26	5.00	0.00	0.08	0.08
18.90	0.69	0.26	5.00	0.00	0.08	0.08
18.95	0.69	0.26	5.00	0.00	0.08	0.08
19.00	0.69	0.26	5.00	0.00	0.08	0.08
19.05	0.69	0.26	5.00	0.00	0.08	0.08
19.10	0.69	0.26	5.00	0.00	0.08	0.08
19.15	0.69	0.26	5.00	0.00	0.08	0.08
19.20	0.69	0.26	5.00	0.00	0.08	0.08
19.25	0.69	0.26	5.00	0.00	0.08	0.08
19.30	0.69	0.26	5.00	0.00	0.08	0.08
19.35	0.69	0.26	5.00	0.00	0.08	0.08
19.40	0.69	0.26	5.00	0.00	0.08	0.08
19.45	0.69	0.26	5.00	0.00	0.08	0.08
19.50	0.69	0.26	5.00	0.00	0.08	0.08
19.55	0.69	0.26	5.00	0.00	0.08	0.08
19.60	0.69	0.26	5.00	0.00	0.08	0.08
19.65	0.69	0.26	5.00	0.00	0.08	0.08
19.70	0.69	0.26	5.00	0.00	0.08	0.08
19.75	0.69	0.26	5.00	0.00	0.08	0.08
19.80	0.69	0.26	5.00	0.00	0.08	0.08
19.85	0.69	0.26	5.00	0.00	0.08	0.08
19.90	0.69	0.26	5.00	0.00	0.08	0.08
19.95	0.69	0.26	5.00	0.00	0.08	0.08
20.00	0.69	0.26	5.00	0.00	0.08	0.08
20.05	0.69	0.26	5.00	0.00	0.08	0.08
20.10	0.69	0.26	5.00	0.00	0.08	0.08
20.15	0.69	0.26	5.00	0.00	0.08	0.08
20.20	0.69	0.26	5.00	0.00	0.08	0.08

20.25	0.69	0.26	5.00	0.00	0.08	0.08
20.30	0.69	0.26	5.00	0.00	0.08	0.08
20.35	0.69	0.26	5.00	0.00	0.08	0.08
20.40	0.69	0.26	5.00	0.00	0.08	0.08
20.45	0.69	0.26	5.00	0.00	0.08	0.08
20.50	0.69	0.26	5.00	0.00	0.08	0.08
20.55	0.69	0.26	5.00	0.00	0.07	0.07
20.60	0.69	0.26	5.00	0.00	0.07	0.07
20.65	0.69	0.26	5.00	0.00	0.07	0.07
20.70	0.69	0.26	5.00	0.00	0.07	0.07
20.75	0.69	0.26	5.00	0.00	0.07	0.07
20.80	0.69	0.26	5.00	0.00	0.07	0.07
20.85	0.69	0.26	5.00	0.00	0.07	0.07
20.90	0.69	0.26	5.00	0.00	0.07	0.07
20.95	0.69	0.26	5.00	0.00	0.07	0.07
21.00	0.69	0.26	5.00	0.00	0.07	0.07
21.05	0.69	0.26	5.00	0.00	0.07	0.07
21.10	0.69	0.26	5.00	0.00	0.07	0.07
21.15	0.69	0.26	5.00	0.00	0.07	0.07
21.20	0.69	0.26	5.00	0.00	0.07	0.07
21.25	0.69	0.26	5.00	0.00	0.07	0.07
21.30	0.69	0.26	5.00	0.00	0.07	0.07
21.35	0.69	0.26	5.00	0.00	0.07	0.07
21.40	0.69	0.26	5.00	0.00	0.07	0.07
21.45	0.69	0.26	5.00	0.00	0.07	0.07
21.50	0.69	0.26	5.00	0.00	0.07	0.07
21.55	0.69	0.26	5.00	0.00	0.07	0.07
21.60	0.69	0.26	5.00	0.00	0.07	0.07
21.65	0.69	0.26	5.00	0.00	0.07	0.07
21.70	0.69	0.26	5.00	0.00	0.07	0.07
21.75	0.69	0.26	5.00	0.00	0.07	0.07
21.80	0.69	0.26	5.00	0.00	0.07	0.07
21.85	0.69	0.26	5.00	0.00	0.07	0.07
21.90	0.69	0.26	5.00	0.00	0.07	0.07
21.95	0.69	0.26	5.00	0.00	0.07	0.07
22.00	0.69	0.26	5.00	0.00	0.07	0.07
22.05	0.69	0.26	5.00	0.00	0.07	0.07
22.10	0.69	0.26	5.00	0.00	0.07	0.07
22.15	0.69	0.26	5.00	0.00	0.07	0.07
22.20	0.69	0.26	5.00	0.00	0.07	0.07
22.25	0.69	0.26	5.00	0.00	0.07	0.07
22.30	0.69	0.26	5.00	0.00	0.07	0.07
22.35	0.69	0.26	5.00	0.00	0.07	0.07
22.40	0.69	0.26	5.00	0.00	0.07	0.07
22.45	0.69	0.26	5.00	0.00	0.07	0.07
22.50	0.69	0.26	5.00	0.00	0.07	0.07
22.55	0.69	0.26	5.00	0.00	0.07	0.07
22.60	0.69	0.26	5.00	0.00	0.07	0.07
22.65	0.69	0.26	5.00	0.00	0.07	0.07
22.70	0.69	0.26	5.00	0.00	0.07	0.07
22.75	0.69	0.26	5.00	0.00	0.07	0.07
22.80	0.69	0.26	5.00	0.00	0.07	0.07
22.85	0.69	0.26	5.00	0.00	0.07	0.07
22.90	0.69	0.26	5.00	0.00	0.07	0.07

22.95	0.69	0.26	5.00	0.00	0.07	0.07
23.00	0.69	0.26	5.00	0.00	0.07	0.07
23.05	0.69	0.26	5.00	0.00	0.07	0.07
23.10	0.69	0.26	5.00	0.00	0.07	0.07
23.15	0.69	0.26	5.00	0.00	0.07	0.07
23.20	0.69	0.26	5.00	0.00	0.06	0.06
23.25	0.69	0.26	5.00	0.00	0.06	0.06
23.30	0.69	0.26	5.00	0.00	0.06	0.06
23.35	0.69	0.26	5.00	0.00	0.06	0.06
23.40	0.69	0.26	5.00	0.00	0.06	0.06
23.45	0.69	0.26	5.00	0.00	0.06	0.06
23.50	0.69	0.26	5.00	0.00	0.06	0.06
23.55	0.69	0.26	5.00	0.00	0.06	0.06
23.60	0.69	0.26	5.00	0.00	0.06	0.06
23.65	0.69	0.26	5.00	0.00	0.06	0.06
23.70	0.69	0.26	5.00	0.00	0.06	0.06
23.75	0.69	0.26	5.00	0.00	0.06	0.06
23.80	0.69	0.26	5.00	0.00	0.06	0.06
23.85	0.69	0.26	5.00	0.00	0.06	0.06
23.90	0.69	0.26	5.00	0.00	0.06	0.06
23.95	0.69	0.26	5.00	0.00	0.06	0.06
24.00	0.65	0.26	5.00	0.00	0.06	0.06
24.05	0.62	0.26	5.00	0.00	0.06	0.06
24.10	0.60	0.26	5.00	0.00	0.06	0.06
24.15	0.59	0.26	5.00	0.00	0.06	0.06
24.20	0.57	0.26	5.00	0.00	0.06	0.06
24.25	0.56	0.26	5.00	0.00	0.06	0.06
24.30	0.56	0.26	5.00	0.00	0.06	0.06
24.35	0.55	0.26	5.00	0.00	0.06	0.06
24.40	0.54	0.26	5.00	0.00	0.06	0.06
24.45	0.53	0.26	5.00	0.00	0.06	0.06
24.50	0.53	0.26	5.00	0.00	0.06	0.06
24.55	0.52	0.26	5.00	0.00	0.06	0.06
24.60	0.52	0.26	5.00	0.00	0.06	0.06
24.65	0.51	0.26	5.00	0.00	0.06	0.06
24.70	0.51	0.26	5.00	0.00	0.06	0.06
24.75	0.51	0.26	5.00	0.00	0.06	0.06
24.80	0.50	0.26	5.00	0.00	0.06	0.06
24.85	0.50	0.26	5.00	0.00	0.06	0.06
24.90	0.49	0.26	5.00	0.00	0.06	0.06
24.95	0.49	0.26	5.00	0.00	0.06	0.06
25.00	0.49	0.26	5.00	0.00	0.06	0.06
25.05	0.48	0.26	5.00	0.00	0.06	0.06
25.10	0.48	0.26	5.00	0.00	0.05	0.05
25.15	0.48	0.26	5.00	0.00	0.05	0.05
25.20	0.47	0.26	5.00	0.00	0.05	0.05
25.25	0.47	0.26	5.00	0.00	0.05	0.05
25.30	0.47	0.26	5.00	0.00	0.05	0.05
25.35	0.47	0.26	5.00	0.00	0.05	0.05
25.40	0.46	0.26	5.00	0.00	0.05	0.05
25.45	0.46	0.26	5.00	0.00	0.05	0.05
25.50	0.46	0.26	5.00	0.00	0.05	0.05
25.55	0.45	0.26	5.00	0.00	0.05	0.05
25.60	0.45	0.26	5.00	0.00	0.05	0.05

25.65	0.45	0.26	5.00	0.00	0.05	0.05
25.70	0.45	0.26	5.00	0.00	0.05	0.05
25.75	0.44	0.26	5.00	0.00	0.05	0.05
25.80	0.44	0.26	5.00	0.00	0.05	0.05
25.85	0.44	0.26	5.00	0.00	0.05	0.05
25.90	0.44	0.26	5.00	0.00	0.05	0.05
25.95	0.44	0.26	5.00	0.00	0.05	0.05
26.00	0.43	0.26	5.00	0.00	0.05	0.05
26.05	0.44	0.26	5.00	0.00	0.05	0.05
26.10	0.44	0.26	5.00	0.00	0.05	0.05
26.15	0.44	0.26	5.00	0.00	0.05	0.05
26.20	0.45	0.26	5.00	0.00	0.05	0.05
26.25	0.45	0.26	5.00	0.00	0.05	0.05
26.30	0.46	0.26	5.00	0.00	0.05	0.05
26.35	0.46	0.26	5.00	0.00	0.05	0.05
26.40	0.47	0.26	5.00	0.00	0.05	0.05
26.45	0.47	0.26	5.00	0.00	0.05	0.05
26.50	0.47	0.26	5.00	0.00	0.05	0.05
26.55	0.48	0.26	5.00	0.00	0.05	0.05
26.60	0.48	0.26	5.00	0.00	0.04	0.04
26.65	0.49	0.26	5.00	0.00	0.04	0.04
26.70	0.50	0.26	5.00	0.00	0.04	0.04
26.75	0.50	0.26	5.00	0.00	0.04	0.04
26.80	0.51	0.26	5.00	0.00	0.04	0.04
26.85	0.51	0.26	5.00	0.00	0.04	0.04
26.90	0.52	0.26	5.00	0.00	0.04	0.04
26.95	0.53	0.26	5.00	0.00	0.04	0.04
27.00	0.54	0.26	5.00	0.00	0.04	0.04
27.05	0.55	0.26	5.00	0.00	0.04	0.04
27.10	0.56	0.26	5.00	0.00	0.04	0.04
27.15	0.57	0.26	5.00	0.00	0.04	0.04
27.20	0.59	0.26	5.00	0.00	0.04	0.04
27.25	0.62	0.26	5.00	0.00	0.04	0.04
27.30	0.66	0.26	5.00	0.00	0.04	0.04
27.35	0.69	0.26	5.00	0.00	0.04	0.04
27.40	0.69	0.26	5.00	0.00	0.04	0.04
27.45	0.69	0.26	5.00	0.00	0.04	0.04
27.50	0.69	0.26	5.00	0.00	0.04	0.04
27.55	0.69	0.26	5.00	0.00	0.04	0.04
27.60	0.69	0.26	5.00	0.00	0.04	0.04
27.65	0.69	0.26	5.00	0.00	0.04	0.04
27.70	0.69	0.26	5.00	0.00	0.04	0.04
27.75	0.69	0.26	5.00	0.00	0.04	0.04
27.80	0.69	0.26	5.00	0.00	0.04	0.04
27.85	0.69	0.26	5.00	0.00	0.04	0.04
27.90	0.69	0.26	5.00	0.00	0.04	0.04
27.95	0.69	0.26	5.00	0.00	0.04	0.04
28.00	0.69	0.26	5.00	0.00	0.04	0.04
28.05	0.69	0.26	5.00	0.00	0.04	0.04
28.10	0.69	0.26	5.00	0.00	0.04	0.04
28.15	0.69	0.26	5.00	0.00	0.04	0.04
28.20	0.69	0.26	5.00	0.00	0.04	0.04
28.25	0.69	0.26	5.00	0.00	0.04	0.04
28.30	0.69	0.26	5.00	0.00	0.04	0.04

28.35	0.69	0.26	5.00	0.00	0.03	0.03
28.40	0.69	0.26	5.00	0.00	0.03	0.03
28.45	0.69	0.26	5.00	0.00	0.03	0.03
28.50	0.69	0.26	5.00	0.00	0.03	0.03
28.55	0.69	0.26	5.00	0.00	0.03	0.03
28.60	0.69	0.26	5.00	0.00	0.03	0.03
28.65	0.69	0.26	5.00	0.00	0.03	0.03
28.70	0.69	0.26	5.00	0.00	0.03	0.03
28.75	0.69	0.26	5.00	0.00	0.03	0.03
28.80	0.69	0.26	5.00	0.00	0.03	0.03
28.85	0.69	0.26	5.00	0.00	0.03	0.03
28.90	0.69	0.26	5.00	0.00	0.03	0.03
28.95	0.69	0.26	5.00	0.00	0.03	0.03
29.00	0.69	0.26	5.00	0.00	0.03	0.03
29.05	0.69	0.26	5.00	0.00	0.03	0.03
29.10	0.69	0.26	5.00	0.00	0.03	0.03
29.15	0.69	0.26	5.00	0.00	0.03	0.03
29.20	0.69	0.26	5.00	0.00	0.03	0.03
29.25	0.69	0.26	5.00	0.00	0.03	0.03
29.30	0.69	0.26	5.00	0.00	0.03	0.03
29.35	0.69	0.26	5.00	0.00	0.03	0.03
29.40	0.69	0.26	5.00	0.00	0.03	0.03
29.45	0.69	0.26	5.00	0.00	0.03	0.03
29.50	0.69	0.26	5.00	0.00	0.03	0.03
29.55	0.69	0.26	5.00	0.00	0.03	0.03
29.60	0.69	0.26	5.00	0.00	0.03	0.03
29.65	0.69	0.26	5.00	0.00	0.03	0.03
29.70	0.69	0.26	5.00	0.00	0.03	0.03
29.75	0.69	0.26	5.00	0.00	0.03	0.03
29.80	0.69	0.26	5.00	0.00	0.03	0.03
29.85	0.68	0.26	5.00	0.00	0.03	0.03
29.90	0.68	0.26	5.00	0.00	0.03	0.03
29.95	0.68	0.26	5.00	0.00	0.03	0.03
30.00	0.68	0.26	5.00	0.00	0.03	0.03
30.05	0.68	0.26	5.00	0.00	0.03	0.03
30.10	0.68	0.26	5.00	0.00	0.03	0.03
30.15	0.68	0.26	5.00	0.00	0.03	0.03
30.20	0.68	0.26	5.00	0.00	0.03	0.03
30.25	0.68	0.26	5.00	0.00	0.03	0.03
30.30	0.68	0.26	5.00	0.00	0.03	0.03
30.35	0.68	0.26	5.00	0.00	0.03	0.03
30.40	0.68	0.26	5.00	0.00	0.03	0.03
30.45	0.68	0.26	5.00	0.00	0.03	0.03
30.50	0.68	0.26	5.00	0.00	0.03	0.03
30.55	0.68	0.26	5.00	0.00	0.03	0.03
30.60	0.68	0.26	5.00	0.00	0.03	0.03
30.65	0.68	0.26	5.00	0.00	0.03	0.03
30.70	0.68	0.26	5.00	0.00	0.03	0.03
30.75	0.68	0.26	5.00	0.00	0.03	0.03
30.80	0.68	0.26	5.00	0.00	0.03	0.03
30.85	0.68	0.26	5.00	0.00	0.03	0.03
30.90	0.68	0.25	5.00	0.00	0.03	0.03
30.95	0.68	0.25	5.00	0.00	0.02	0.02
31.00	0.68	0.25	5.00	0.00	0.02	0.02

31.05	0.68	0.25	5.00	0.00	0.02	0.02
31.10	0.68	0.25	5.00	0.00	0.02	0.02
31.15	0.68	0.25	5.00	0.00	0.02	0.02
31.20	0.68	0.25	5.00	0.00	0.02	0.02
31.25	0.68	0.25	5.00	0.00	0.02	0.02
31.30	0.68	0.25	5.00	0.00	0.02	0.02
31.35	0.68	0.25	5.00	0.00	0.02	0.02
31.40	0.68	0.25	5.00	0.00	0.02	0.02
31.45	0.68	0.25	5.00	0.00	0.02	0.02
31.50	0.68	0.25	5.00	0.00	0.02	0.02
31.55	0.68	0.25	5.00	0.00	0.02	0.02
31.60	0.68	0.25	5.00	0.00	0.02	0.02
31.65	0.68	0.25	5.00	0.00	0.02	0.02
31.70	0.68	0.25	5.00	0.00	0.02	0.02
31.75	0.68	0.25	5.00	0.00	0.02	0.02
31.80	0.68	0.25	5.00	0.00	0.02	0.02
31.85	0.68	0.25	5.00	0.00	0.02	0.02
31.90	0.68	0.25	5.00	0.00	0.02	0.02
31.95	0.68	0.25	5.00	0.00	0.02	0.02
32.00	0.68	0.25	5.00	0.00	0.02	0.02
32.05	0.68	0.25	5.00	0.00	0.02	0.02
32.10	0.68	0.25	5.00	0.00	0.02	0.02
32.15	0.68	0.25	5.00	0.00	0.02	0.02
32.20	0.68	0.25	5.00	0.00	0.02	0.02
32.25	0.68	0.25	5.00	0.00	0.02	0.02
32.30	0.68	0.25	5.00	0.00	0.02	0.02
32.35	0.68	0.25	5.00	0.00	0.02	0.02
32.40	0.68	0.25	5.00	0.00	0.02	0.02
32.45	0.67	0.25	5.00	0.00	0.02	0.02
32.50	0.67	0.25	5.00	0.00	0.02	0.02
32.55	0.67	0.25	5.00	0.00	0.02	0.02
32.60	0.67	0.25	5.00	0.00	0.02	0.02
32.65	0.67	0.25	5.00	0.00	0.02	0.02
32.70	0.67	0.25	5.00	0.00	0.02	0.02
32.75	0.67	0.25	5.00	0.00	0.02	0.02
32.80	0.67	0.25	5.00	0.00	0.02	0.02
32.85	0.67	0.25	5.00	0.00	0.02	0.02
32.90	0.67	0.25	5.00	0.00	0.02	0.02
32.95	0.67	0.25	5.00	0.00	0.02	0.02
33.00	0.67	0.25	5.00	0.00	0.02	0.02
33.05	0.67	0.25	5.00	0.00	0.02	0.02
33.10	0.67	0.25	5.00	0.00	0.02	0.02
33.15	0.67	0.25	5.00	0.00	0.02	0.02
33.20	0.67	0.25	5.00	0.00	0.02	0.02
33.25	0.67	0.25	5.00	0.00	0.02	0.02
33.30	0.67	0.25	5.00	0.00	0.02	0.02
33.35	0.67	0.25	5.00	0.00	0.02	0.02
33.40	0.67	0.25	5.00	0.00	0.02	0.02
33.45	0.67	0.25	5.00	0.00	0.02	0.02
33.50	0.67	0.25	5.00	0.00	0.02	0.02
33.55	0.67	0.25	5.00	0.00	0.01	0.01
33.60	0.67	0.25	5.00	0.00	0.01	0.01
33.65	0.67	0.25	5.00	0.00	0.01	0.01
33.70	0.67	0.25	5.00	0.00	0.01	0.01

33.75	0.67	0.25	5.00	0.00	0.01	0.01
33.80	0.67	0.25	5.00	0.00	0.01	0.01
33.85	0.67	0.25	5.00	0.00	0.01	0.01
33.90	0.67	0.25	5.00	0.00	0.01	0.01
33.95	0.67	0.25	5.00	0.00	0.01	0.01
34.00	0.67	0.25	5.00	0.00	0.01	0.01
34.05	0.67	0.25	5.00	0.00	0.01	0.01
34.10	0.67	0.25	5.00	0.00	0.01	0.01
34.15	0.67	0.25	5.00	0.00	0.01	0.01
34.20	0.67	0.25	5.00	0.00	0.01	0.01
34.25	0.67	0.25	5.00	0.00	0.01	0.01
34.30	0.67	0.25	5.00	0.00	0.01	0.01
34.35	0.67	0.25	5.00	0.00	0.01	0.01
34.40	0.67	0.25	5.00	0.00	0.01	0.01
34.45	0.67	0.25	5.00	0.00	0.01	0.01
34.50	0.67	0.25	5.00	0.00	0.01	0.01
34.55	0.67	0.25	5.00	0.00	0.01	0.01
34.60	0.67	0.25	5.00	0.00	0.01	0.01
34.65	0.67	0.25	5.00	0.00	0.01	0.01
34.70	0.67	0.25	5.00	0.00	0.01	0.01
34.75	0.67	0.25	5.00	0.00	0.01	0.01
34.80	0.67	0.25	5.00	0.00	0.01	0.01
34.85	0.67	0.25	5.00	0.00	0.01	0.01
34.90	0.67	0.25	5.00	0.00	0.01	0.01
34.95	0.67	0.25	5.00	0.00	0.01	0.01
35.00	0.67	0.25	5.00	0.00	0.01	0.01
35.05	0.67	0.25	5.00	0.00	0.01	0.01
35.10	0.67	0.25	5.00	0.00	0.01	0.01
35.15	0.66	0.25	5.00	0.00	0.01	0.01
35.20	0.66	0.25	5.00	0.00	0.01	0.01
35.25	0.66	0.25	5.00	0.00	0.01	0.01
35.30	0.66	0.25	5.00	0.00	0.01	0.01
35.35	0.66	0.24	5.00	0.00	0.00	0.00
35.40	0.66	0.24	5.00	0.00	0.00	0.00
35.45	0.66	0.24	5.00	0.00	0.00	0.00
35.50	0.66	0.24	5.00	0.00	0.00	0.00
35.55	0.65	0.24	5.00	0.00	0.00	0.00
35.60	0.61	0.24	5.00	0.00	0.00	0.00
35.65	0.58	0.24	5.00	0.00	0.00	0.00
35.70	0.56	0.24	5.00	0.00	0.00	0.00
35.75	0.55	0.24	5.00	0.00	0.00	0.00
35.80	0.54	0.24	5.00	0.00	0.00	0.00
35.85	0.53	0.24	5.00	0.00	0.00	0.00
35.90	0.52	0.24	5.00	0.00	0.00	0.00
35.95	0.51	0.24	5.00	0.00	0.00	0.00
36.00	0.51	0.24	5.00	0.00	0.00	0.00
36.05	0.53	0.24	2.16	0.00	0.00	0.00
36.10	0.56	0.24	2.29	0.00	0.00	0.00
36.15	0.63	0.24	2.58	0.00	0.00	0.00
36.20	0.66	0.24	2.72	0.00	0.00	0.00
36.25	0.66	0.24	2.72	0.00	0.00	0.00
36.30	0.66	0.24	2.71	0.00	0.00	0.00
36.35	0.66	0.24	2.71	0.00	0.00	0.00
36.40	0.66	0.24	2.71	0.00	0.00	0.00

36.45	0.66	0.24	2.71	0.00	0.00	0.00
36.50	0.66	0.24	2.71	0.00	0.00	0.00
36.55	0.66	0.24	2.71	0.00	0.00	0.00
36.60	0.66	0.24	2.71	0.00	0.00	0.00
36.65	0.66	0.24	2.71	0.00	0.00	0.00
36.70	0.66	0.24	2.71	0.00	0.00	0.00
36.75	0.66	0.24	2.71	0.00	0.00	0.00
36.80	0.66	0.24	2.70	0.00	0.00	0.00
36.85	0.66	0.24	2.70	0.00	0.00	0.00
36.90	0.66	0.24	2.70	0.00	0.00	0.00
36.95	0.66	0.24	2.70	0.00	0.00	0.00
37.00	0.66	0.24	2.70	0.00	0.00	0.00
37.05	0.66	0.24	2.70	0.00	0.00	0.00
37.10	0.66	0.24	2.70	0.00	0.00	0.00
37.15	0.66	0.24	2.70	0.00	0.00	0.00
37.20	0.66	0.24	2.70	0.00	0.00	0.00
37.25	0.66	0.24	2.70	0.00	0.00	0.00
37.30	0.66	0.24	2.69	0.00	0.00	0.00
37.35	0.66	0.24	2.69	0.00	0.00	0.00
37.40	0.66	0.24	2.69	0.00	0.00	0.00
37.45	0.66	0.24	2.69	0.00	0.00	0.00
37.50	0.66	0.25	2.69	0.00	0.00	0.00
37.55	0.66	0.25	2.69	0.00	0.00	0.00
37.60	0.66	0.25	2.69	0.00	0.00	0.00
37.65	0.66	0.25	2.69	0.00	0.00	0.00
37.70	0.66	0.25	2.69	0.00	0.00	0.00
37.75	0.66	0.25	2.69	0.00	0.00	0.00
37.80	0.66	0.25	2.69	0.00	0.00	0.00
37.85	0.66	0.25	2.68	0.00	0.00	0.00
37.90	0.66	0.25	2.68	0.00	0.00	0.00
37.95	0.66	0.25	2.68	0.00	0.00	0.00
38.00	0.66	0.25	2.68	0.00	0.00	0.00
38.05	0.66	0.25	2.68	0.00	0.00	0.00
38.10	0.66	0.25	2.68	0.00	0.00	0.00
38.15	0.66	0.25	2.68	0.00	0.00	0.00
38.20	0.66	0.25	2.68	0.00	0.00	0.00
38.25	0.66	0.25	2.68	0.00	0.00	0.00
38.30	0.66	0.25	2.68	0.00	0.00	0.00
38.35	0.66	0.25	2.68	0.00	0.00	0.00
38.40	0.66	0.25	2.67	0.00	0.00	0.00
38.45	0.66	0.25	2.67	0.00	0.00	0.00
38.50	0.66	0.25	2.67	0.00	0.00	0.00
38.55	0.66	0.25	2.67	0.00	0.00	0.00
38.60	0.66	0.25	2.67	0.00	0.00	0.00
38.65	0.66	0.25	2.67	0.00	0.00	0.00
38.70	0.66	0.25	2.67	0.00	0.00	0.00
38.75	0.66	0.25	2.67	0.00	0.00	0.00
38.80	0.66	0.25	2.67	0.00	0.00	0.00
38.85	0.66	0.25	2.67	0.00	0.00	0.00
38.90	0.66	0.25	2.67	0.00	0.00	0.00
38.95	0.66	0.25	2.67	0.00	0.00	0.00
39.00	0.66	0.25	2.66	0.00	0.00	0.00
39.05	0.66	0.25	2.66	0.00	0.00	0.00
39.10	0.66	0.25	2.66	0.00	0.00	0.00

39.15	0.66	0.25	2.66	0.00	0.00	0.00
39.20	0.66	0.25	2.66	0.00	0.00	0.00
39.25	0.66	0.25	2.66	0.00	0.00	0.00
39.30	0.66	0.25	2.66	0.00	0.00	0.00
39.35	0.66	0.25	2.66	0.00	0.00	0.00
39.40	0.66	0.25	2.66	0.00	0.00	0.00
39.45	0.66	0.25	2.66	0.00	0.00	0.00
39.50	0.66	0.25	2.66	0.00	0.00	0.00
39.55	0.66	0.25	2.66	0.00	0.00	0.00
39.60	0.66	0.25	2.66	0.00	0.00	0.00
39.65	0.66	0.25	2.65	0.00	0.00	0.00
39.70	0.66	0.25	2.65	0.00	0.00	0.00
39.75	0.66	0.25	2.65	0.00	0.00	0.00
39.80	0.66	0.25	2.65	0.00	0.00	0.00
39.85	0.66	0.25	2.65	0.00	0.00	0.00
39.90	0.66	0.25	2.65	0.00	0.00	0.00
39.95	0.66	0.25	2.65	0.00	0.00	0.00
40.00	0.66	0.25	2.65	0.00	0.00	0.00
40.05	0.66	0.25	2.65	0.00	0.00	0.00
40.10	0.65	0.25	2.65	0.00	0.00	0.00
40.15	0.65	0.25	2.65	0.00	0.00	0.00
40.20	0.65	0.25	2.65	0.00	0.00	0.00
40.25	0.65	0.25	2.65	0.00	0.00	0.00
40.30	0.65	0.25	2.64	0.00	0.00	0.00
40.35	0.65	0.25	2.64	0.00	0.00	0.00
40.40	0.65	0.25	2.64	0.00	0.00	0.00
40.45	0.65	0.25	2.64	0.00	0.00	0.00
40.50	0.65	0.25	2.64	0.00	0.00	0.00
40.55	0.65	0.25	2.64	0.00	0.00	0.00
40.60	0.65	0.25	2.64	0.00	0.00	0.00
40.65	0.65	0.25	2.64	0.00	0.00	0.00
40.70	0.65	0.25	2.64	0.00	0.00	0.00
40.75	0.65	0.25	2.64	0.00	0.00	0.00
40.80	0.65	0.25	2.64	0.00	0.00	0.00
40.85	0.65	0.25	2.64	0.00	0.00	0.00
40.90	0.65	0.25	2.64	0.00	0.00	0.00
40.95	0.65	0.25	2.64	0.00	0.00	0.00
41.00	0.65	0.25	2.64	0.00	0.00	0.00
41.05	0.65	0.25	2.63	0.00	0.00	0.00
41.10	0.65	0.25	2.63	0.00	0.00	0.00
41.15	0.65	0.25	2.63	0.00	0.00	0.00
41.20	0.65	0.25	2.63	0.00	0.00	0.00
41.25	0.65	0.25	2.63	0.00	0.00	0.00
41.30	0.65	0.25	2.63	0.00	0.00	0.00
41.35	0.65	0.25	2.63	0.00	0.00	0.00
41.40	0.65	0.25	2.63	0.00	0.00	0.00
41.45	0.65	0.25	2.63	0.00	0.00	0.00
41.50	0.65	0.25	2.63	0.00	0.00	0.00
41.55	0.65	0.25	2.63	0.00	0.00	0.00
41.60	0.65	0.25	2.63	0.00	0.00	0.00
41.65	0.65	0.25	2.63	0.00	0.00	0.00
41.70	0.65	0.25	2.63	0.00	0.00	0.00
41.75	0.65	0.25	2.63	0.00	0.00	0.00
41.80	0.65	0.25	2.63	0.00	0.00	0.00

41.85	0.65	0.25	2.62	0.00	0.00	0.00
41.90	0.65	0.25	2.62	0.00	0.00	0.00
41.95	0.65	0.25	2.62	0.00	0.00	0.00
42.00	0.65	0.25	2.62	0.00	0.00	0.00
42.05	0.65	0.25	2.62	0.00	0.00	0.00
42.10	0.65	0.25	2.62	0.00	0.00	0.00
42.15	0.65	0.25	2.62	0.00	0.00	0.00
42.20	0.65	0.25	2.62	0.00	0.00	0.00
42.25	0.65	0.25	2.62	0.00	0.00	0.00
42.30	0.65	0.25	2.62	0.00	0.00	0.00
42.35	0.65	0.25	2.62	0.00	0.00	0.00
42.40	0.65	0.25	2.62	0.00	0.00	0.00
42.45	0.65	0.25	2.62	0.00	0.00	0.00
42.50	0.65	0.25	2.62	0.00	0.00	0.00
42.55	0.65	0.25	2.62	0.00	0.00	0.00
42.60	0.65	0.25	2.62	0.00	0.00	0.00
42.65	0.65	0.25	2.62	0.00	0.00	0.00
42.70	0.65	0.25	2.61	0.00	0.00	0.00
42.75	0.65	0.25	2.61	0.00	0.00	0.00
42.80	0.65	0.25	2.61	0.00	0.00	0.00
42.85	0.65	0.25	2.61	0.00	0.00	0.00
42.90	0.65	0.25	2.61	0.00	0.00	0.00
42.95	0.65	0.25	2.61	0.00	0.00	0.00
43.00	0.65	0.25	2.61	0.00	0.00	0.00
43.05	0.65	0.25	2.61	0.00	0.00	0.00
43.10	0.65	0.25	2.61	0.00	0.00	0.00
43.15	0.65	0.25	2.61	0.00	0.00	0.00
43.20	0.65	0.25	2.61	0.00	0.00	0.00
43.25	0.65	0.25	2.61	0.00	0.00	0.00
43.30	0.65	0.25	2.61	0.00	0.00	0.00
43.35	0.65	0.25	2.61	0.00	0.00	0.00
43.40	0.65	0.25	2.61	0.00	0.00	0.00
43.45	0.65	0.25	2.61	0.00	0.00	0.00
43.50	0.65	0.25	2.61	0.00	0.00	0.00
43.55	0.65	0.25	2.61	0.00	0.00	0.00
43.60	0.65	0.25	2.61	0.00	0.00	0.00
43.65	0.65	0.25	2.61	0.00	0.00	0.00
43.70	0.65	0.25	2.60	0.00	0.00	0.00
43.75	0.65	0.25	2.60	0.00	0.00	0.00
43.80	0.65	0.25	2.60	0.00	0.00	0.00
43.85	0.65	0.25	2.60	0.00	0.00	0.00
43.90	0.65	0.25	2.60	0.00	0.00	0.00
43.95	0.65	0.25	2.60	0.00	0.00	0.00
44.00	0.65	0.25	2.60	0.00	0.00	0.00
44.05	0.65	0.25	2.60	0.00	0.00	0.00
44.10	0.65	0.25	2.60	0.00	0.00	0.00
44.15	0.65	0.25	2.60	0.00	0.00	0.00
44.20	0.65	0.25	2.60	0.00	0.00	0.00
44.25	0.65	0.25	2.60	0.00	0.00	0.00
44.30	0.65	0.25	2.60	0.00	0.00	0.00
44.35	0.65	0.25	2.60	0.00	0.00	0.00
44.40	0.65	0.25	2.60	0.00	0.00	0.00
44.45	0.65	0.25	2.60	0.00	0.00	0.00
44.50	0.65	0.25	2.60	0.00	0.00	0.00

44.55	0.65	0.25	2.60	0.00	0.00	0.00
44.60	0.65	0.25	2.60	0.00	0.00	0.00
44.65	0.65	0.25	2.60	0.00	0.00	0.00
44.70	0.65	0.25	2.60	0.00	0.00	0.00
44.75	0.65	0.25	2.60	0.00	0.00	0.00
44.80	0.65	0.25	2.59	0.00	0.00	0.00
44.85	0.65	0.25	2.59	0.00	0.00	0.00
44.90	0.65	0.25	2.59	0.00	0.00	0.00
44.95	0.65	0.25	2.59	0.00	0.00	0.00
45.00	0.65	0.25	2.59	0.00	0.00	0.00
45.05	2.00	0.25	5.00	0.00	0.00	0.00
45.10	2.00	0.25	5.00	0.00	0.00	0.00
45.15	2.00	0.25	5.00	0.00	0.00	0.00
45.20	2.00	0.25	5.00	0.00	0.00	0.00
45.25	2.00	0.25	5.00	0.00	0.00	0.00
45.30	2.00	0.25	5.00	0.00	0.00	0.00
45.35	2.00	0.25	5.00	0.00	0.00	0.00
45.40	2.00	0.25	5.00	0.00	0.00	0.00
45.45	2.00	0.25	5.00	0.00	0.00	0.00
45.50	2.00	0.25	5.00	0.00	0.00	0.00
45.55	2.00	0.25	5.00	0.00	0.00	0.00
45.60	2.00	0.25	5.00	0.00	0.00	0.00
45.65	2.00	0.25	5.00	0.00	0.00	0.00
45.70	2.00	0.25	5.00	0.00	0.00	0.00
45.75	2.00	0.25	5.00	0.00	0.00	0.00
45.80	2.00	0.25	5.00	0.00	0.00	0.00
45.85	2.00	0.25	5.00	0.00	0.00	0.00
45.90	2.00	0.25	5.00	0.00	0.00	0.00
45.95	2.00	0.25	5.00	0.00	0.00	0.00
46.00	2.00	0.25	5.00	0.00	0.00	0.00
46.05	2.00	0.25	5.00	0.00	0.00	0.00
46.10	2.00	0.25	5.00	0.00	0.00	0.00
46.15	2.00	0.25	5.00	0.00	0.00	0.00
46.20	2.00	0.25	5.00	0.00	0.00	0.00
46.25	2.00	0.25	5.00	0.00	0.00	0.00
46.30	2.00	0.25	5.00	0.00	0.00	0.00
46.35	2.00	0.25	5.00	0.00	0.00	0.00
46.40	2.00	0.25	5.00	0.00	0.00	0.00
46.45	2.00	0.25	5.00	0.00	0.00	0.00
46.50	2.00	0.25	5.00	0.00	0.00	0.00
46.55	2.00	0.25	5.00	0.00	0.00	0.00
46.60	2.00	0.25	5.00	0.00	0.00	0.00
46.65	2.00	0.25	5.00	0.00	0.00	0.00
46.70	2.00	0.25	5.00	0.00	0.00	0.00
46.75	2.00	0.25	5.00	0.00	0.00	0.00
46.80	2.00	0.25	5.00	0.00	0.00	0.00
46.85	2.00	0.25	5.00	0.00	0.00	0.00
46.90	2.00	0.25	5.00	0.00	0.00	0.00
46.95	2.00	0.25	5.00	0.00	0.00	0.00
47.00	2.00	0.25	5.00	0.00	0.00	0.00
47.05	2.00	0.25	5.00	0.00	0.00	0.00
47.10	2.00	0.25	5.00	0.00	0.00	0.00
47.15	2.00	0.25	5.00	0.00	0.00	0.00
47.20	2.00	0.25	5.00	0.00	0.00	0.00

47.25	2.00	0.25	5.00	0.00	0.00	0.00
47.30	2.00	0.25	5.00	0.00	0.00	0.00
47.35	2.00	0.25	5.00	0.00	0.00	0.00
47.40	2.00	0.25	5.00	0.00	0.00	0.00
47.45	2.00	0.25	5.00	0.00	0.00	0.00
47.50	2.00	0.25	5.00	0.00	0.00	0.00
47.55	2.00	0.25	5.00	0.00	0.00	0.00
47.60	2.00	0.25	5.00	0.00	0.00	0.00
47.65	2.00	0.25	5.00	0.00	0.00	0.00
47.70	2.00	0.25	5.00	0.00	0.00	0.00
47.75	2.00	0.25	5.00	0.00	0.00	0.00
47.80	2.00	0.25	5.00	0.00	0.00	0.00
47.85	2.00	0.25	5.00	0.00	0.00	0.00
47.90	2.00	0.25	5.00	0.00	0.00	0.00
47.95	2.00	0.25	5.00	0.00	0.00	0.00
48.00	2.00	0.25	5.00	0.00	0.00	0.00
48.05	2.00	0.25	5.00	0.00	0.00	0.00
48.10	2.00	0.25	5.00	0.00	0.00	0.00
48.15	2.00	0.25	5.00	0.00	0.00	0.00
48.20	2.00	0.25	5.00	0.00	0.00	0.00
48.25	2.00	0.25	5.00	0.00	0.00	0.00
48.30	2.00	0.25	5.00	0.00	0.00	0.00
48.35	2.00	0.25	5.00	0.00	0.00	0.00
48.40	2.00	0.25	5.00	0.00	0.00	0.00
48.45	2.00	0.25	5.00	0.00	0.00	0.00
48.50	2.00	0.25	5.00	0.00	0.00	0.00
48.55	2.00	0.25	5.00	0.00	0.00	0.00
48.60	2.00	0.25	5.00	0.00	0.00	0.00
48.65	2.00	0.25	5.00	0.00	0.00	0.00
48.70	2.00	0.25	5.00	0.00	0.00	0.00
48.75	2.00	0.25	5.00	0.00	0.00	0.00
48.80	2.00	0.25	5.00	0.00	0.00	0.00
48.85	2.00	0.25	5.00	0.00	0.00	0.00
48.90	2.00	0.25	5.00	0.00	0.00	0.00
48.95	2.00	0.25	5.00	0.00	0.00	0.00
49.00	2.00	0.25	5.00	0.00	0.00	0.00
49.05	0.64	0.25	2.57	0.00	0.00	0.00
49.10	0.64	0.25	2.57	0.00	0.00	0.00
49.15	0.64	0.25	2.57	0.00	0.00	0.00
49.20	0.64	0.25	2.57	0.00	0.00	0.00
49.25	0.64	0.25	2.57	0.00	0.00	0.00
49.30	0.64	0.25	2.57	0.00	0.00	0.00
49.35	0.64	0.25	2.57	0.00	0.00	0.00
49.40	0.61	0.25	2.46	0.00	0.00	0.00
49.45	0.55	0.25	2.23	0.00	0.00	0.00
49.50	0.52	0.25	2.11	0.00	0.00	0.00
49.55	0.50	0.25	2.03	0.00	0.00	0.00
49.60	0.49	0.25	1.98	0.00	0.00	0.00
49.65	0.48	0.25	1.93	0.00	0.00	0.00
49.70	0.47	0.25	1.88	0.00	0.00	0.00
49.75	0.46	0.25	1.85	0.00	0.00	0.00
49.80	0.45	0.25	1.81	0.00	0.00	0.00
49.85	0.44	0.25	1.78	0.00	0.00	0.00
49.90	0.43	0.25	1.75	0.00	0.00	0.00

49.95	0.43	0.25	1.72	0.00	0.00	0.00
50.00	0.42	0.25	1.70	0.00	0.00	0.00
50.05	0.41	0.25	1.67	0.00	0.00	0.00
50.10	0.41	0.25	1.65	0.00	0.00	0.00
50.15	0.40	0.25	1.63	0.00	0.00	0.00
50.20	0.40	0.25	1.60	0.00	0.00	0.00
50.25	0.39	0.25	1.58	0.00	0.00	0.00
50.30	0.39	0.25	1.56	0.00	0.00	0.00
50.35	0.38	0.25	1.54	0.00	0.00	0.00
50.40	0.38	0.25	1.52	0.00	0.00	0.00
50.45	0.37	0.25	1.50	0.00	0.00	0.00
50.50	0.37	0.25	1.48	0.00	0.00	0.00
50.55	0.36	0.25	1.46	0.00	0.00	0.00
50.60	0.36	0.25	1.44	0.00	0.00	0.00
50.65	0.35	0.25	1.43	0.00	0.00	0.00
50.70	0.35	0.25	1.41	0.00	0.00	0.00
50.75	0.34	0.25	1.39	0.00	0.00	0.00
50.80	0.34	0.25	1.38	0.00	0.00	0.00
50.85	0.34	0.25	1.36	0.00	0.00	0.00
50.90	0.33	0.25	1.34	0.00	0.00	0.00
50.95	0.33	0.25	1.33	0.00	0.00	0.00
51.00	0.32	0.25	1.31	0.00	0.00	0.00

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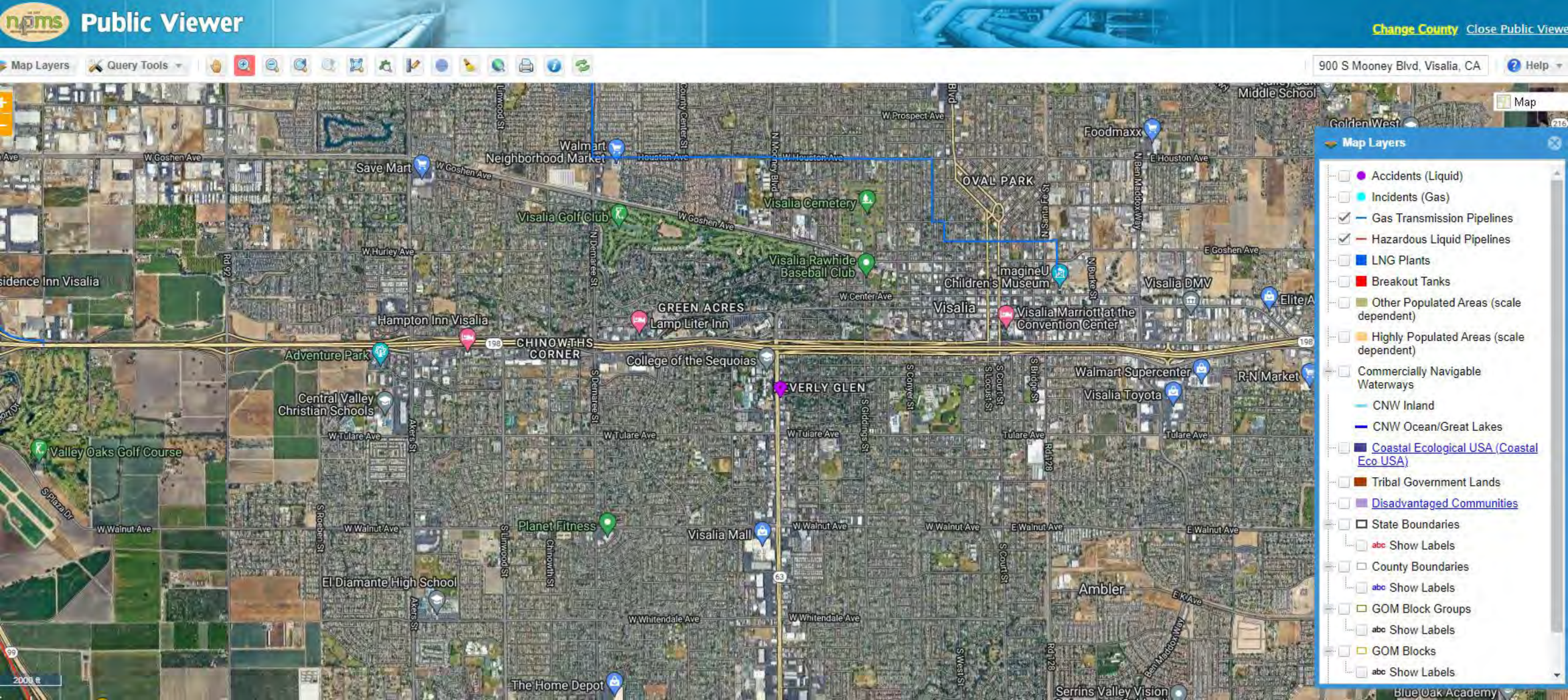
* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm(1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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1 atm(atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils


Public Viewer
Change County
Close Public Viewer
Map Layers
Query Tools
900 S Mooney Blvd, Visalia, CA
Help
Map
Map Layers
Accidents (Liquid)
Incidents (Gas)
Gas Transmission Pipelines
Hazardous Liquid Pipelines
LNG Plants
Breakout Tanks
Other Populated Areas (scale dependent)
Highly Populated Areas (scale dependent)
Commercially Navigable Waterways
CNW Inland
CNW Ocean/Great Lakes
Coastal Ecological USA (Coastal Eco USA)
Tribal Government Lands
Disadvantaged Communities
State Boundaries
Show Labels
County Boundaries
Show Labels
GOM Block Groups
Show Labels
GOM Blocks
Show Labels
Walmart Neighborhood Market
Save Mart
Visalia Golf Club
Visalia Cemetery
OVAL PARK
Foodmaxx
Visalia Rawhide Baseball Club
ImagineU Children's Museum
Visalia DMV
Visalia
Visalia Marriott at the Convention Center
GREEN ACRES
Lamp Liter Inn
Hampton Inn Visalia
CHINOWTHS CORNER
Adventure Park
College of the Sequoias
VERLY GLEN
Walmart Supercenter
R-N Market
Visalia Toyota
Central Valley Christian Schools
Valley Oaks Golf Course
Planet Fitness
Visalia Mall
El Diamante High School
Ambler
The Home Depot
Serrins Valley Vision
Blue Oak Academy
Middle School
Golden West
W Goshen Ave
W Prospect Ave
W Houston Ave
E Houston Ave
W Hurley Ave
E Goshen Ave
W Center Ave
W Tulare Ave
E Tulare Ave
W Walnut Ave
E Walnut Ave
W Whitendale Ave
E K Ave
N Mooney Blvd
N Ben Maddox Way
N Burke St
S Conyer St
S Locust St
S Court St
S Bridge St
S Gibbons St
S Demaree St
N Demaree St
S Akers St
S Roeben St
S Linwood St
Chinowth St
S Plaza Dr
S Westfall St
Rd 92
Rd 128
198
99
63

DSA

403-C

CALGREEN CODE SUBMITTAL CHECKLIST

PURPOSE

K-12 schools and community college projects submitted to the Division of the State Architect (DSA) as a single project, increments, or pre-checked (PC) applications, must comply with the Title 24, Part 11, California Green Building Standards Code (CALGreen). This form lists the mandatory measures required for CALGreen compliance, as applicable, and must be submitted with the construction documents. Applicable CALGreen mandatory measures, including applicable worksheets and declaration statements, are required to be included in the construction documents.

CALGreen Section 306 Voluntary Measures encourages building practices that improve public health, safety, and general welfare by promoting the use of building concepts which minimize the building's impact on the environment and promote a more sustainable design. Chapter 5 Nonresidential Mandatory Measures that are not adopted by DSA-SS, and Nonresidential Voluntary Measures indicated in CALGreen Appendix A5, Divisions A5.1 through A5.5, are voluntary. Including voluntary measures into the project is encouraged; however, DSA will not review the compliance of voluntary measures included in the project.

Documentation demonstrating compliance with CALGreen Division 5.2 – ENERGY EFFICIENCY, which requires compliance of the project with the current edition of Title 24, Part 6, California Energy Code, is not addressed herein. All applicable energy forms must be included in the Project per California Energy Code requirements.

INSTRUCTIONS

For project submission, provide the CALGreen Mandatory Measures that are required for the project, submit the completed form DSA 403-C, completed applicable worksheets, and applicable signed declaration statements with the project documents.

If the project does not require compliance with CALGreen mandatory measures addressed herein check "NO" in the box at the top of the checklist. If compliance with CALGreen mandatory measures addressed herein is required, check "YES" in the box at the top of the checklist and proceed to fill out the checklist as to the applicable measures.

All clear fields must be filled with a sheet number and/or a specification section number indicating the location where required items are included in the construction documents. Regulatory requirements not applicable to the scope of work shall be indicated "N/A". Do not provide input to shaded boxes in the checklist.

The design professional in responsible charge is responsible for CALGreen compliance and completion of form DSA 403-C. Prior to project submittal, compliance of mandatory measures supported by the requisite information shall be verified. Any questions related to the applicability of a listed item to the specific project scope should be clarified with DSA staff at a pre-application meeting or prior to project registration.

Plan review will not commence until this completed checklist is submitted, and any applicable worksheets and declaration statements are signed and included in the construction documents.

APPLICABILITY

CALGreen regulatory requirements for public schools and community colleges consist of the scoping provisions in CALGreen Chapter 3, Section 301.4 and the nonresidential mandatory measures indicated as adopted by DSA-SS in Chapter 5 Matrix Adoption Table below.

CALGREEN CODE SUBMITTAL CHECKLIST

CHAPTER 5 – NONRESIDENTIAL MANDATORY MEASURES FOR K-12 SCHOOLS AND COMMUNITY COLLEGES

COMPLIANCE WITH THE CALGREEN MANDATORY MEASURES INDCATED HEREIN IS REQUIRED FOR THE PROJECT	☐ Yes ☐ No
CALGREEN SECTION – TITLE	**Provide: Sheet(s) # in Plans Specification Section Complete as indicated or "N/A" if not applicable.**
5.105 - DECONSTRUCTION AND REUSEOF EXISTING STRUCTURES	
Section 5.105.1[1] and 5.105.2 Reuse of existing building. Provide WS-3 in construction documents, see EXHIBIT A below.	
5.106 – SITE DEVELOPMENT	
Section 5.106.4.2 Bicycle parking.	
Section 5.106.4.2.1 Student bicycle parking.	
Section 5.106.4.2.2 Staff bicycle parking.	
Section 5.106.5.6 Electric vehicle charging.	
Section 5.106.5.6.1 Electric vehicle capable spaces.	
Section 5.106.5.6.2 or 5.106.5.6.3 Electric vehicle charging stations (EVCS).	
Section 5.106.8 Light pollution reduction.	
Section 5.106.10 Grading and paving.	
Section 5.106.12 Shade trees.	
Section 5.106.12.1 Surface parking area shade tree calculation.	
Section 5.106.12.2 Landscape area shade tree calculation.	
Section 5.106.12.3 Hardscape area shade tree calculation.	
5.303 INDOOR WATER USE	
Section 5.303.3 Water conserving plumbing fixtures.	
Section 5.303.3.1 Water closets.	

Section 5.303.3.2.1 Wall mounted urinals.	
Section 5.303.3.2.1 Floor mounted (or other) urinals.	
Section 5.303.3.3.1 Single showerheads.	
Section 5.303.3.3.2 Multiple showerheads serving one shower.	
Section 5.303.3.4.1 Nonresidential lavatory faucets.	
Section 5.303.3.4.2 Kitchen faucets.	
Section 5.303.3.4.3 Wash fountains.	
Section 5.303.3.4.4 Metering faucets.	
Section 5.303.3.4.5 Metering faucets for wash fountains.	
Section 5.303.3.4.6 Pre-rinse spray valve.	
5.304 OUTDOOR WATER USE	
Section 5.304.6 Outdoor potable water use.	
Section 5.304.6.1 Newly constructed landscapes. Submit *DSA 1-L: Outdoor Water Use Self-Certification of Landscape Irrigation Design and Documentation* and enter “Y”.	
Section 5.304.6.2 Rehabilitated landscapes. Submit DSA 1-L and enter “Y”.	
5.407 WATER RESISTANCE AND MOISTURE MANAGEMENT	
Section 5.407.1 Weather protection.	
Section 5.407.2 Moisture control.	
Section 5.407.2.1 Sprinklers (landscape irrigation).	
Section 5.407.2.2.1 Exterior door protection for primary exterior entries.	
Section 5.407.2.2.1 Flashing.	
5.408 CONSTRUCTION WASTE REDUCTION, DISPOSAL AND RECYCLING	
Section 5.408.1 Construction waste management.	
Section 5.408.1.1 Construction waste management plan.	
Section 5.408.1.2 Waste management company.	
Section 5.408.1.3 Waste stream reduction alternative.	

CALGREEN CODE SUBMITTAL CHECKLIST

SECTION 5.409 LIFE CYCLE ASSESSMENT		
	Section 5.409.2 Whole building life cycle assessment[1]. Provide signed declaration statement and worksheet in drawings, see EXHIBIT B below.	
	Section 5.409.3 Product GWP compliance[1] – prescriptive compliance. Provide signed declaration statement in drawings, see EXHIBIT C below.	
5.410 BUILDING MAINTENANCE AND OPERATION		
	Section 5.410.1 Recycling by occupants.	
5.504 POLLUTANT CONTROL		
	Section 5.504.3 Covering of duct openings and protection of mechanical equipment during construction.	
	Section 5.504.4 Finish material pollutant control.	
	Section 5.504.4.1 Adhesives sealants and caulks.	
	Section 5.504.4.3 Paints and coatings.	
	Section 5.504.4.4 Carpet systems.	
	Section 5.504.4.5 Composite wood products.	
	Section 5.504.4.6 Resilient flooring systems.	
	Section 5.504.4.7 Thermal insulation.	
	Section 5.504.4.8 Acoustical ceilings and wall panels.	
	Section 5.504.5.3 Filters (Merv 13).	
5.505 INDOOR MOISTURE CONTROL		
	Section 5.505.1 Indoor moisture control per CBC Sections 1202 (Ventilation) and Chapter 14 (Exterior Walls).	
5.506 INDOOR AIR QUALITY		
	Section 5.506.1 Outside air delivery per California Energy Code Section 120.1, and Chapter 4 of CCR Title 8	
	Section 5.506.3 Carbon dioxide monitoring.	
	Section 5.506.2 Carbon Dioxide ($C0_2$) monitoring in classrooms (energy manage control system).	
	Section 5.506.3 Carbon Dioxide ($C0_2$) monitoring in classrooms (standalone).	

CALGREEN CODE SUBMITTAL CHECKLIST

SECTION 5.507 ENVIRONMENTAL COMFORT		
Section 5.507.4 Acoustical control.		
	Section 5.507.4.1 Exterior noise transmission prescriptive method (detail STC rating)	
	Section 5.507.4.2 Exterior noise transmission performance method (document acoustical analysis)	
	Section 5.507.4.3 Interior sound transmission (detail STC rating)	
SECTION 5.508 OUTDOOR AIR QUALITY		
Section 5.508.1 Ozone depletion and greenhouse gas reductions		
	Section 5.508.1.1 Chlorofluorocarbons (CFCs).	
	Section 5.508.1.1 Halons.	

FOOTNOTES:

1: New construction projects consisting of a total floor area is 50,000 sq. ft. or greater must complete either Section 5.509.2 or Section 5.409.3. Alteration or addition projects consisting of a total floor area of 50,000 sq. ft. or greater must complete Section 5.105.2, 5.409.2, or 5.409.3

Professional in General Responsible Charge Declaration Statement:

As the Professional in General Responsible Charge, I have reviewed the Project Plans and affirm that the documentation submitted is in compliance with the requirements of CALGreen (Title 24, Part 11). Required documentation, applicable worksheets and signed declaration statements are included in the construction documents on the drawing sheet indicated in the completed form. I will verify that all work shown on the DSA approved construction documents necessary for compliance to CALGreen mandatory measures is completed in construction and prior to occupancy.

Signature: _____ Date: _____

Print Full Name: _____

REFERENCES:

California Green Building Standards Code Title 24 Part 11, Chapter 6 Referenced Organizations and Standards
California Energy Code Title 24 Part 6
CCR Title 8, Division 1, Chapter 4

CALGREEN CODE SUBMITTAL CHECKLIST

EXHIBIT A
WORKSHEET (WS-3)
5.105.2 BUILDING REUSE

DOCUMENTATION OF COMPLIANCE OF EXISTING BUILDING REUSE

Total Area of Existing Building(s) _____ SF

Total Area of Aggregate Addition(s) (if applicable) _____ SF

	EXISTING TOTAL AREA (A)	RETAINED TOTAL AREA (B)	% OF RETAINED STRUCTURE (B)/(A)
Primary Structural Elements of Existing Building(s) (foundations; columns, beams, walls, and floors; and lateral elements)	_____ SF	_____ SF	_____ SF
Building Enclosure of Existing Building(s) (roof framing, wall framing and exterior finishes only)	_____ SF	_____ SF	_____ SF

Total % Reuse of Required Elements ≥ 45% _____%

CALGREEN CODE SUBMITTAL CHECKLIST

EXHIBIT B
Section 5.409.2 WHOLE BUILDING LIFE CYCLE ASSESSMENT

Whole Building LCA Information			
Model Information required		**Scope of analysis (Enter "Y" or "N")**	
LCA Modeler (Firm name)		Structure (required)	
Date of Model Run (MM/DD/YY)		Enclosure (required)	
Software and version used		Interiors (optional)	
Model floor area (sq. ft.)		Mech., Elec. Plumb. (optional)	
Calculated percent reduction in global warming potential (GWP)[1]:		Site/landscaping (optional)	
		Fixtures, Furnishings and Equipment (optional)	

Footnote

1) Must be a minimum of 10 percent.

Professional in General Responsible Charge Declaration Statement:

I attest that the Whole Building Life Cycle Analysis has been performed according to the requirements of Title 24, Part 11 (CALGreen), Section 5.409.2 by a minimum 10 percent reduction in global warming potential as compared to a reference baseline building of similar size, function, complexity, type of construction, material specification, and location. Furthermore, I will ensure during construction that the material specifications will be reviewed for substantial conformance with the life cycle assessment indicated on the approved documents so at the close of construction the minimum 10 percent reduction in global warming potential is thereby secured.

Signature:	
Name:	Date:
Address:	License:
City/State/Zip:	Phone:

CALGREEN CODE SUBMITTAL CHECKLIST

EXHIBIT C
Section 5.409.3 PRODUCT GWP COMPLIANCE—PRESCRIPTIVE PATH

Professional in General Responsible Charge Declaration Statement:

I attest that prescriptive compliance has been met according to the requirements of Title 24, Part 11 (CALGreen) Section 5.409.3 and products specified do not exceed the global warming potential as specified in CALGreen Table 5.409.3. Furthermore, I will ensure during construction that the material specifications will be reviewed for substantial conformance with the global warming potential limits indicated on the approved documents.

Signature:	
Name:	Date:
Address:	License:
City/State/Zip:	Phone: