

COUNTY OF MADERA
North Fork Branch
Library Renovation

PROJECT MANUAL
Bid Set
March 6, 2026

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Not Used

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SECTION 001113
ADVERTISEMENT FOR BIDS

**Madera County North Fork Library TI
RFP #2026-01**

NON-MANDATORY PRE-BID CONFERENCE:
Thursday, March 26, 2026 at 10:00 AM

BID OPENING DATE:
Thursday, April 16, 2026, at 2:00 PM

NOTICE IS HEREBY GIVEN that the **General Services Department, County of Madera**, California, acting by and through its Governing Board, hereinafter referred to as the County, will receive up to, but not later than **2:00:00 p.m., PDT, Thursday, April 16, 2026**, sealed bids for the award of a contract for: Project: Madera County North Fork Library TI.

PROJECT LOCATION: 32908 Road 222, North Fork, CA 93643

NON-MANDATORY PRE-BID CONFERENCE: A non-mandatory pre-bid meeting has been scheduled **Thursday, March 26, 2026, at 10:00 AM, PDT** to review the Project's existing conditions. The pre-bid meeting will take place at the project site located at 32908 Road 222, North Fork, CA 93643.

EXAMINATION OF SITE: Each bidder shall examine the site of work before bidding and shall be responsible for having acquired full knowledge of the job and of all problems affecting it. No variations or allowances from the contract sum will be made because of lack of such examination.

PROJECT DESCRIPTION: The proposed project encompasses the comprehensive renovation of an existing mixed-use building featuring an upper-level library and an unoccupied lower level, with no proposed changes to the existing occupancy classification, building type, height, story count, or total floor area. The scope of work involves extensive exterior and site improvements, including new siding, insulation, roofing, weather barriers, waterproofing, windows, storm drainage, retaining walls, and the addition of accessible parking with a compliant path of travel. Interior renovations will include new structural components, partitions, casework, and finishes, alongside the complete replacement of mechanical, plumbing, and electrical systems. Additionally, a new automatic fire sprinkler system will be installed throughout both the upper and lower levels.

CONSTRUCTION COST ESTIMATE: \$3,748,00.00 (Base Scope + Unit Cost #1 + Alt #1)

CONTRACTORS LICENSE: The Contractor shall possess a valid California Class B license at the time this Project is bid. Each bidder shall be a licensed contractor pursuant to the Business and Professions Code and shall be licensed in the appropriate classification(s) of contractor's license(s), for the work bid upon, and must maintain the license throughout the duration of the Contract.

QUESTIONS: All contractual and technical questions should be directed to the, Project Manager, Ricky Arredondo Ricky.Arredondo@maderacounty.com . Questions shall be submitted on the "REQUEST FOR CLARIFICATION" form provided in the Contract Documents.

BID DOCUMENTS: Each bid must conform and be responsive to the Contract Documents and all plans, specifications and any other documents pertaining to the Project, copies of which are now on file and may be obtained on or after March 19, 2026. Contractors may request plans, specifications, and any other documents pertaining to the Project, copies of which are now on file and may be obtained on or after March 19, 2026 via the County's website: <https://www.bidnetdirect.com/california/maderacounty>. Copies are also available through the builder exchange websites. Contact the Project Manager, Ricky Arredondo at (559) 675-7703 or Ricky.Arredondo@maderacounty.com with any issues locating Contract Documents.

BID SUBMITTAL INSTRUCTION: Bids shall be received in the office of the County of Madera, County Administrative Office, General Services Department, 200 West 4th Street, 4th Floor Suite 4200, Madera, California 93637, Attn.: Ricky Arredondo and shall be opened and publicly read aloud at the above-stated time.

PAYMENT AND PERFORMANCE BOND: The successful bidder will be required to furnish the County with a Performance Bond equal to 100% of the successful bid, and a Payment Bond equal to 100% of the successful bid, prior to execution of the Contract. All bonds are to be secured from a surety company that meets all of the State of California bonding requirements, as defined in Code of Civil Procedure Section 995.120, and is authorized by the State of California, and all documents required by Code of Civil Procedure Section 995.660, to the extent required by law.

SUBSTITUTION OF SECURITIES: Pursuant to the provisions of Public Contract Code Section 22300, the successful bidder may substitute certain securities for funds withheld by County to ensure his performance under the Contract. At the request and expense of the successful bidder, securities equivalent to any amount withheld shall be deposited at the discretion of County, with either County or a state or federally chartered bank, as the escrow agent, who shall then pay any funds otherwise subject to retention to the successful bidder. Upon satisfactory completion of the Contract, the securities shall be returned to the successful bidder.

PREVAILING WAGES: The Director of Industrial Relations has determined the general prevailing rate of per diem wages in the locality in which this work is to be performed for each craft or type of worker needed to execute the Contract which will be awarded to the successful bidder, copies of which are on file and will be made available to any interested party upon request. A copy of these rates shall be posted at the job site. It shall be mandatory upon the bidder to whom the Contract is awarded, and upon any subcontractor under him, to comply with all Labor Code provisions, which include, but are not limited to the payment of not less than the said specified rates to all workers employed by them in the execution of the Contract, employment of apprentices, hours of labor and debarment of contractors and subcontractors.

REGISTRATION: This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations. No contractor or subcontractor may be listed on a bid proposal for a public works project or awarded a contract for public work on a public works project, unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5. The County shall not accept a bid or enter into a contract without proof of contractor's and subcontractor's current registration. All contractors must furnish electronic certified payroll records to the Labor Commissioner in the eCPR data system, or equivalent as authorized by the Labor Commissioner.

WITHDRAWAL OF BIDS: The County reserves the right to reject any or all bids or to waive any irregularities or informalities in any bids or in the bidding. No bidder may withdraw his/her bid for a period of sixty (60) days after the date set for the opening thereof.

BID SELECTION: The County shall award the Contract for the Project to the bidder submitting the responsive lowest bid as determined from the base bid and is deemed responsible by the County.

CONSTRUCTION TIME: The successful CONTRACTOR (after receiving the Notice to Proceed) shall have **four hundred thirty four (434)** calendar days to complete all work called for under the Contract Documents.

LIQUIDATED DAMAGES: The liquidated damages will be **\$2,000.00** per day for the project delays that are determined to be attributable to the CONTRACTOR.

Clerk of the Board of Supervisors
County of Madera, California

Publication Dates: April 25, 2025

END OF DOCUMENT

SECTION 00 21 13
INSTRUCTION TO BIDDERS

1. Preparation of Bid Form

The County invites bids on the attached form to be submitted at such time and place as is stated in the Advertisement for Bids. All blanks in the bid form must be appropriately filled in. All bids must be submitted in sealed envelopes bearing on the outside the name of the bidder, his address, and the name of the Project for which the bid is submitted. All prices must be stated in both words and figures where so indicated, and where there is a conflict in the words and figures, the words shall govern. Prices, wording, and notations must be in ink or typewritten. It is the sole responsibility of the bidder to see that his bid is received in proper time. All bids received after the scheduled closing time for receipt of bids will be returned to the bidder unopened.

2. Bid Security

Each bid shall be accompanied by: (a) cash; (b) a certified check made payable to the County; (c) a cashier's check made payable to the County; or (d) a satisfactory bid bond payable to the County executed by the bidder as principal and an admitted surety approved to conduct business in the State of California as surety, in an amount not less than 10% of the maximum amount of the bid. Personal sureties and unregistered surety companies are unacceptable. The California admitted surety insurer, as defined in Code of Civil Procedure Section 995.120, shall be a satisfactory corporate surety. The cash, check or bid bond shall be given as a guarantee that the bidder shall execute the Contract if it be awarded to the bidder in conformity with the Contract Documents and shall provide the surety bond or bonds as specified therein within ten (10) consecutive calendar days after notification of the award of the Contract to the bidder (which date shall be the day following the Board of Supervisors approval of the award).

In the event the bidder to whom the Notice of Intent to Award Contract is given fails or refuses to post the required bonds, as provided in Section 10 below, and return executed copies of the Contract within ten (10) consecutive calendar days from the date of notification of Award of Contract. The County may declare the bidder's bid deposit or bond forfeited as damages caused by the failure of the bidder to post the required bonds and execute such copies of the Contract and may award the Contract to the next lowest responsible bidder or may call for new bids.

3. Faxed and Electronic Mail Bids

All bids must be under sealed cover. The County will not accept any bids or bid modifications submitted by facsimile or electronic mail transmission.

4. Signature

The bid must be signed in the name of the bidder and must bear the signature in longhand of the person or persons duly authorized to sign the bid on behalf of the bidder. All signatures are to be in ink. In the event that the bidder is a joint venture or partnership, there shall be submitted with the bid certifications signed by authorized officers of each of the parties to the joint venture or partnership, naming the individual who shall be the agent of the joint venture or partnership, who shall sign all necessary documents for the joint venture or partnership and who, should the joint venture or partnership be the successful bidder, shall act in all matters relative to the Contract resulting therefrom for the joint venture or partnership.

5. Modifications

Changes in or additions to the bid form, recapitulations of the work bid upon, alternative proposals, or any other modification of the bid form which is not specifically called for in the Contract Documents may result in the County's rejection of the bid as not being responsive to the invitation to bid. No oral or telephonic modification of any bid submitted will be considered and a telegraphic modification may be considered only if the postmark evidence that a confirmation of the telegram duly signed by the bidder was placed in the mail prior to the opening of bids. Bids may be rejected if they show any alteration in form, are incomplete, or contain irregularities of any kind.

6. Erasures/Mutilation of Bid Documents

The bid submitted must not contain any erasures, interlineations, or other corrections unless each such correction is suitably authenticated by affixing in the margin immediately opposite the correction the surname or surnames of the person or persons signing the bid.

Bidders should not deface or mutilate the bid documents to the extent that they may not be usable for construction purposes.

7. Examination of Site and Contract Documents

At its own expense and prior to submitting its bid, each bidder shall visit the site of the proposed work and fully acquaint himself with the conditions relating to the construction and labor so that the bidder may fully understand the facilities, which include but are not limited to difficulties, and restrictions attending the execution of the work under the Contract. Bidders shall thoroughly examine and be familiar with the drawings and specifications. Each bidder shall also determine the local conditions which may, in any way affect the performance of the work, including the prevailing wages and other relevant cost factors; familiarize itself with all federal, state and local laws, ordinances, rules, regulations and codes affecting the performance of the work, including the cost of permits and licenses required for the work; make such surveys and investigations, including investigations of subsurface or latent physical conditions at the site or where work is to be performed. The failure or omission of any bidder to receive or examine any Contract Documents, form, instrument, addendum, or other document or to visit the site and acquaint himself with conditions there existing shall in no way relieve any bidder from any obligation with respect to their bid or to the Contract. The submission of a bid shall be taken as incontrovertible evidence of compliance with this section.

8. Withdrawal of Bids

Any bidder may withdraw his bid either personally, by written request, or by telegraphic request confirmed in the manner specified above at any time prior to the scheduled closing time for receipt of bids. Any request to withdraw a bid shall be so worded so as not to reveal the amount of the original bid. Withdrawn bids may be resubmitted until the scheduled time for receipt of bids, so long as the resubmitted bids are in full conformance with the Contract Documents. After the scheduled closing time for receipt of bids, a bidder may not withdraw its bid until the expiration of sixty (60) calendar days, after which time a bid may be withdrawn only in writing and in advance of actual award of the Contract.

9. Contracts and Bonds

The Contract form which the successful bidder, as Contractor, will be required to execute, and the form of the Performance Bond equal to 100% of the successful bid, and Payment Bond equal to 100% of the successful bid which the bidder will be required to furnish at the time of execution of the Contract, are included in the Contract Documents and should be carefully examined by the bidder. The Performance and Payment Bonds must be executed by an admitted Surety approved to conduct business in the State of California, pursuant to Code of Civil Procedure Section 995.120. In addition, to the extent required by law, the Payment and Performance Bonds must be accompanied by a certified copy of the certificate of authority of the insurer issued by the Insurance Commissioner of the State of California, a certificate from the Clerk of the County of Madera that the certificate of authority of the insurer has not been surrendered, revoked, cancelled, annulled, or suspended, or if it has that it has been renewed, and four copies of the insurer's most recent annual statement and quarterly statement filed with the Department of Insurance of the State of California.

10. Interpretation of Plans and Documents

If any person contemplating submitting a bid for the proposed Contract is in doubt as to the true meaning of any part of the drawings, specifications, or other Contract Documents, or finds discrepancies in, or omissions from the drawings and specifications, that person may submit to the Project Manager a written request for an interpretation or correction thereof. Such submittal must be made on the "REQUEST FOR CLARIFICATION" form provided within Contract Documents, and must be submitted to the Project Manager, Ricky Arredondo Ricky.Arredondo@maderacounty.com

The person submitting the request will be responsible for its prompt delivery. Any interpretation or correction of the Contract Documents will be made only by addendum duly issued. Any addenda or bulletins issued by the Architect during the time of bidding or forming a part of the documents furnished to bidders for bid preparation shall be covered in the bid and made part of the Contract Documents. In the event that an addendum or bulletin, setting forth material changes, additions or deletions is issued when there is 72 hours or less to the bid deadline, the County will extend the bidding deadline by at least 72 hours. No person is authorized to make any oral interpretation of any provision in the Contract Documents to any bidder, and no bidder is authorized to rely on any such unauthorized oral interpretation.

11. Bidders Interested in More Than One Bid

No person, firm, or corporation shall be allowed to make, or file, or be interested in more than one bid for the same work unless alternate bids are specifically called for. A person, firm, or corporation that has submitted a sub-proposal to a bidder, or that has quoted prices of materials to a bidder, is not thereby disqualified from submitting a sub-proposal or quoting prices to other bidders or making a proposal.

12. **Noncollusion Affidavit**
Bidders on all public works contracts are required to submit an affidavit of Noncollusion with their bid. This form is included with the bid package and must be signed under the penalty of perjury and dated.
13. **Reservation**
The County reserves the right to reject any or all bids, or to waive any irregularities or informalities in any bids or in the bidding.
14. **Award of Contract**
The award of the Contract, if approved by the County Board of Supervisors, will be to the lowest responsible bidder whose bid complies with all of the prescribed requirements, based on the base bid in accordance with Public Contract Code Section 20103.8.a and the Contract Documents. However, the County may elect to exclude, at its discretion, any or all of the bid alternates from the final contract.
15. **Listing Subcontractors**
Each bidder shall set forth on the form provided herein and submit with its sealed bid at the time bids are due the name, the location of place of business, and the California contractor license number of each subcontractor who will perform work, labor, furnish materials, or render service to the bidder on said Contract in excess of one-half (1/2) of one percent (1%) of the total bid. An inadvertent error in listing the California contractor license number shall not be grounds for filing a bid protest or grounds for considering the bid nonresponsive if the corrected contractor's license number is submitted to the public entity by the prime contractor within 24 hours after the bid opening and provided the corrected contractor's license number corresponds to the submitted name and location for that subcontractor. No time extension will be allowed for submission of additional information required by this Section.
16. **Evidence of Responsibility**
If bidders were not required to pre-qualify prior to being allowed to bid on the Project, the following information will be required to accompany bids submitted to the County: Each bid shall be supported by a statement of the bidder's experience as of recent date on the form entitled "BIDDER'S QUALIFICATIONS," bound herein. County may also consider the qualifications and experience of subcontractors and other persons and organizations (including those who are to furnish the principal items of material and equipment) proposed for those portions of the work. Operating costs, maintenance considerations, performance data and guarantees of materials and equipment may also be considered by the County. In this regard, the County may conduct such investigations as the County deems necessary to assist in the evaluation of any bid and to establish the responsibility, qualifications and financial ability of the bidder, proposed subcontractors, and other persons and organizations to do the work in accordance with the Contract Documents to the County's satisfaction within the prescribed time; the County reserves the right to reject the bid of any bidder who does not pass any such evaluation to the satisfaction of the County.
17. **Workers' Compensation**
In accordance with the provisions of Section 3700 of the Labor Code, Contractor shall secure the payment of compensation to his employees. Contractor shall sign and file with the County the following certificate prior to performing the work under this Contract:
- I am aware of the provisions of Section 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 such provisions before commencing the performance of the work of this Contract.
- The form of such certificate, Contractors Certificate Regarding Workers Compensation, is included as part of the Contract Documents.
18. **Substitution of Security**
The Contract Documents call for monthly progress payments based upon the percentage of the work completed. The County will retain five percent (5%) of each progress payment as security for completion of the work. At the request and expense of the successful bidder, the County will substitute securities for the amount so retained in accordance with Public Contract Code Section 22300 and the Contract Documents.
19. **Prevailing Wages**
The County has obtained from the Director of the Department of Industrial Relations the general prevailing rate of per diem wages in the locality in which this work is to be performed for each craft or type of worker needed to execute the Contract. These rates are on file at www.dir.ca.gov. Copies

may be obtained on request. Bidders are advised that a copy of these rates must be posted at each job site.

20. Debarment of Contractors and Subcontractors

In accordance with the provisions of the Labor Code, Contractors or subcontractors may not perform work on a public works project with a subcontractor who is ineligible to perform work on a public project pursuant to Section 1777.1 or Section 1777.7 of the Labor Code. Any contract on a public works project entered into between a contractor and a debarred subcontractor is void as a matter of law. A debarred subcontractor may not receive any public money for performing work as a subcontractor on a public works contract. Any public money that is paid or may have been paid to a debarred subcontractor by a contract on the Project shall be returned to the County. The successful bidder, as Contractor, shall be responsible for the payment of wages to workers of a debarred subcontractor who has been allowed to work on the Project.

21. Contractor's License

To perform the work required for this Project, bidders must possess the appropriate Contractor's License for the portion of the work bid upon, and bidders must maintain the license throughout the duration of the Contract. If, at the time the bids are opened, bidder is not licensed to perform the Project in accordance with division 3, chapter 9 of the Business and Professions Code and the Advertisement for Bids, the bid will not be considered.

The first payment for work or material under any contract shall not be made unless and until the Registrar of Contractors verifies to the County that the records of the Contractor's State License Board indicate that the Contractor was properly licensed at the time the contract was awarded. Any bidder or contractor not so licensed shall be subject to all legal penalties imposed by law, including, but not limited to, any appropriate disciplinary action by the Contractor's State License Board. Failure of the bidder to obtain proper and adequate licensing for an award of a contract shall constitute a failure to execute the contract and shall result in the forfeiture of the security by the bidder.

22. Storm Water Permit for Construction Activity

Required

23. Bid Deposit Return

The County will return the security accompanying the bids of all unsuccessful bidders no later than sixty (60) calendar days after award of the Contract.

24. Insurance

Prior to commencement of the work the successful bidder shall purchase and maintain insurance as set forth in the General Conditions, in the amounts the specified in the Supplementary Conditions to these Contract Documents, and in a form acceptable to the County, from a company or companies lawfully authorized to do business in California as admitted carriers having an "A" policy holders rating and a financial size rating of at least Class VII in accordance with the most current Best's Key Rating Guide, Property-Casualty. Such insurance shall be adequate to protect themselves from claims under Workers' Compensation Acts, and from claims from damages for personal injury, including death, and damage to property, which may arise from operations under the Contract and from the ownership, maintenance or uses of motor vehicles, or claims involving blanket contractual liability applicable to the successful bidder's obligations under the Contract Documents, and completed operations, independent contractors, and Broad Form Property damage, without exclusion for collapse, explosion, demolition, underground coverage, and excavating. The successful bidder shall be required to file with the County certificates of such insurance, and shall name, by way of endorsement on any policy of insurance, the County, Construction Manager, and Architect as additional insured. Failure to furnish such evidence of insurance may be considered default by the successful bidder.

25. Request For Substitutions

- a. For purposes of this provision the term "substitution" shall mean the substitution of any material, product, thing or service that is substantially equal or better in every respect to that so indicated or specified in the specifications.
- b. Pursuant to Public Contract Code Section 3400(b) the County may make a finding designating certain materials, products, things, or services by specific brand or trade name for the statutorily enumerated purposes. As required by Section 3400 (b) the County may have made such findings as may be further described in the Supplementary Conditions. These findings if made, as well as the materials, products, things, or services and their specific brand or trade names that must be used for the Project may be found in the Supplementary Conditions, if applicable.

- c. Unless specifically designated in the General Conditions, whenever in specifications any material, product, thing or service is indicated or specified by grade, patent, or proprietary name or by name of manufacturer, such specifications shall be deemed to be used for the purpose of facilitating the description of the material, product thing, or service desired and shall be deemed to be followed by words "or equal." Bidders may, unless otherwise stated, offer for substitution any material, product, thing, or service which shall be substantially equal or better in every respect to that so indicated or specified. However, the County has adopted certain uniform standards for certain materials, products, things, and/or services. If any material, product, thing, or service offered for substitution by Bidders is not, in the opinion of the Architect and the County, substantially equal or better in every respect to that specified, Bidders shall furnish the material, product, thing, or service specified. The burden of proof as to the equality of any material, product, thing, or service shall rest with the Bidders.
- d. Bidders shall submit requests together with substantiating data for substitution of any "or equal" material, product, thing, or service no later than 5 days prior to the bid date. Provisions authorizing submission of "or equal" substitution justification data shall not in any way authorize an extension of time for performance of this Contract. Furthermore, if a proposed "or equal" substitution request is rejected, a Bidder shall be responsible for including the specified material, product, thing, or service in its bid. The County shall not be responsible for any costs of Bidders associated with "or equal" substitution requests. The County has the complete and sole discretion to determine if a material, product, thing, or service is an "or equal" material, product, thing, or service that may be substituted.
- e. For purposes of subdivision (d) above, data required to substantiate requests for substitutions of an "or equal" material, product, thing, or service data shall include a signed affidavit from the Bidder stating that the substituted "or equal" material, product, thing, or service is equivalent to that specified in the specification in every way except as listed on the affidavit. Substantiating data shall also include any and all illustrations, specifications, and other relevant data including catalogue information which describes the requested substituted "or equal" material, product, thing, or service and substantiates that it is an "or equal" to the material product, thing, or service specified. In addition, the submittal documentation must also include a statement of the cost implications of the substitution being requested stating whether and why the substitution of the "or equal" material, product, thing, or service will reduce or increase the Contract Price. The substantiating data must also include information regarding the durability and lifecycle cost of the requested substituted "or equal" material, product, thing, or service. Failure to submit all the needed substantiating data, including the signed affidavit, to the Architect in a timely fashion so that the substitution can be adequately reviewed may result in the rejection of the proposed substitution. The Architect is not obligated to review multiple substitution submittals for the same materials, products, things, or services due to the Bidder's failure to submit a complete package initially.
- f. Time limitations in this Article must be complied with strictly and in no case will an extension of time for completion be granted because of Bidder's failure to request the substitution of an alternative item at the times and manner set forth herein in subdivision (d). Further, the Bidder shall bear the costs of all engineering work associated with the review of submittals for substitution of equals.
- g. In event Bidder furnishes material, product, thing, or service more expensive than that specified, the difference in cost of such material, product, thing, or service so furnished shall be borne by the Bidder.

26. Anti-Discrimination

It is the policy of the County that in connection with all work performed under contracts, there be no discrimination against any prospective or active employees engaged in the work because of race, color, ancestry, national origin, religious creed, sex, age or marital status. The successful bidder agrees to comply with applicable Federal and California laws including, but not limited to, the California Fair Employment Practice Act, beginning with Government Code 12900, and Labor Code 1735. In addition, the successful bidder agrees to require like compliance by any subcontractors employed on the work by him.

27. Pre-Bid Meeting

A mandatory pre-bid meeting has been scheduled March 26, 2026, at 10:00 a.m. to review the Project's existing conditions. The pre-bid meeting will take place at 32908 Rd 222, North Fork, CA 93643. Representatives of the County, Architect and consulting engineers will be present to answer any

questions bidders have regarding this Project. Bids will not be accepted from any bidder who did not attend the mandatory pre-bid meeting. Bidders will sign a certificate of attendance at mandatory pre-bid meeting which shall be submitted with their bid. Only bidders attending the pre-bid meeting will receive any addenda that is issued.

All questions regarding this project shall be in writing and shall be received by the Project Manager, no later than **2:00 p.m. PDT, April 2, 2026**. Questions shall be submitted on the "REQUEST FOR INTERPRETATION" form provided in the Contract Documents and shall be submitted to the Project Ricky Arredondo at Ricky.Arredondo@maderacounty.com

28. No Telephone Availability

Bidders are advised that on bid date telephones WILL NOT be available at the County Administrative Offices for use by bidders or their representatives.

29. Ethics in Bidding.

The County expects the bidders to maintain high ethical standards in engaging in the competitive bidding process. The bid amount of one bidder should not be divulged to another before the award of the subcontract or order, nor should it be used by bidders to secure a lower proposal from another bidder on that project (bid shopping). Subcontractors or Suppliers should not request information for the bidder regarding any sub-bid in order to submit a lower proposal on that project (bid peddling). The County will consider any bidder found to be engaging in such practices to be a non-responsible bidder and may reject its bid on that ground.

30. Contract Procedures.

a. The Contract Documents contemplate the following procedures upon receipt of bid:

1. The County will give the successful bidder a Notice of Award of Contract.
2. Following the giving of the Notice of Award of Contract, the successful bidder shall post the Performance and Payment Bonds, provide certificates of insurance, and other certificates, and return executed copies of bonds and Contracts to the County pursuant to the timelines specified herein.

END OF DOCUMENT

SECTION 004113
BID FORM

Company

BID TO: County of Madera, acting by and through its Board of Supervisors, herein called the "County":

- Pursuant to and in compliance with your Notice to Contractors Calling for Bids and the other documents relating thereto, the undersigned Bidder, having thoroughly examined and familiarized himself with the terms of the Contract, the local conditions affecting the performance of the Contract and the cost of the work at the place where the work is to be done, and with the drawings and specifications and other Contract Documents, hereby proposes and agrees to perform, within the time stipulated, the Contract, including all of its component parts, and everything required to be performed, including its acceptance by the County and to provide and furnish any and all of the labor, materials, tools, expendable equipment, and all utility and transportation services necessary to perform the Contract and complete in a workmanlike manner all of the work required in connection with the Project described below:

All in strict conformity with the drawings and specifications and other Contract Documents, including addenda nos. listed below and on file at the office of the said County.

COMPANY NAME:	
Project:	Madera County North Fork Branch Library Renovation
All prices shall be submitted as Lump Sum Prices written in words, and figures. In the event of discrepancy between the words and figures of the Lump Sum Price, words shall prevail. All sums shall include all applicable taxes and costs.	

BASE BID:	
	\$
<i>Price in Words</i>	<i>Price in Figures</i>
UNIT COST #1: ADA PARKING:	
	\$
<i>Price in Words</i>	<i>Price in Figures</i>
ALT #1: SOUTH DECK SQUARE FOOTAGE (335 SF):	
	\$
<i>Price in Words</i>	<i>Price in Figures</i>
ALT #2: SOUTH DECK ADDITIONAL SQUARE FOOTAGE (+165 SF):	
	\$
<i>Price in Words</i>	<i>Price in Figures</i>
ALT #3: Irrigation:	
	\$
<i>Price in Words</i>	<i>Price in Figures</i>

ALT #4: CHILDRENS ROOM GLASS WALL:	\$
Price in Words	Price in Figures
ALT #5: MEETING ROOM GLASS WALL:	\$
Price in Words	Price in Figures

Acknowledgement of Addendum:	
Addendum No. _____ Dated _____	Addendum No. _____ Dated _____
Addendum No. _____ Dated _____	Addendum No. _____ Dated _____
Addendum No. _____ Dated _____	Addendum No. _____ Dated _____

2. It is understood that the County reserves the right to reject this bid and that this bid shall remain open and not be withdrawn for the period specified in the Advertisement for Bids.
3. Attached is the required bid security in the amount of not less than 10% of the Bid: \$_____. Bid bond, certified check, cashier's check, or cash (circle one).
4. Non-collusion affidavit is attached hereto.
5. The required list of proposed subcontractors is attached hereto.
6. It is understood and agreed that if written notice of the acceptance of this bid is mailed, telegraphed, or delivered to the undersigned after the opening of the bid, and within the time this bid is required to remain open, or at any time thereafter before this bid is withdrawn, the undersigned will execute and deliver to the County a contract in the form attached hereto in accordance with the bid as accepted. The undersigned will submit the executed Contract, Performance Bond and Payment Bond for Public Works, and insurance Certificates as specified, all within ten (10) consecutive calendar days after notification of award of Contract. The work under the Contract shall be commenced by the undersigned bidder, if awarded the contract, on the date to be stated in the County's Notice to the Contractor to Proceed and shall be completed by the Contractor in the time specified in the Contract Documents. The Contractor shall not start work on the Project until all paperwork required herein is timely and correctly submitted to the County. No time extensions shall be granted to Contractor for Contractor's failure to comply with these provisions.
7. Notice of acceptance or requests for additional information should be addressed to the undersigned at the address stated below:

8. The names of all persons interested in the foregoing proposal as principals are as follows:

(IMPORTANT NOTICE: If bidder or other interested person is a corporation, state legal name of corporation, also names of the president, secretary, treasurer, and manager thereof; if a copartnership, state true name of firm, also names of all individual copartners comprising the firm; if bidder or other interested person is an individual, state first and last names in full.)

9. Bidder certifies that he is licensed in accordance with the law providing for the registration of Contractors, License No. _____, Expiration Date _____, class of license _____. If the bidder is a joint venture, each member of the joint venture must include the above information.

Public Works Contractor Registration Number: _____

10. Pursuant to Section 7103.5 of the Public Contract Code submitting a bid to the County, the bidder offers and agrees that if the bid is accepted, it will assign to County all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, materials, or services by the bidder for sale to the purchasing body pursuant to the bid. Such assignment shall be made and become effective at the time the purchasing body tenders final payment to the bidder.

Proper Name of Bidder

Address

Signature of Bidder

Date

Note: If bidder is a corporation or partners authorized to sign contracts on behalf of the partnership; and if bidder is an individual, the bidder's signature shall be placed above. If bidder is a corporation, affix corporation seal.

I, _____ the _____ of the bidder, hereby certify under penalty of perjury under the laws of the State of California, that all of the information submitted by the bidder in connection with this bid and all of the representations made herein are true and correct. Executed on this _____ day of _____ at _____ County, California.

Proper Name of Bidder _____

By _____

Signature of Bidder _____

Bidder must submit the following documents with this Bid Form, or the County may deem the Bid nonresponsive:

- Proposed Subcontractors Form
- Bidders Qualifications
- Non-Collusion Affidavit
- Contractor's Certification Regarding Workers' Compensation
- Bid Bond
- Department of Industrial Relations - Public Works Contractor Registration Number

END OF SECTION

SECTION 00 43 36
PROPOSED SUBCONTRACTORS FORM

In compliance with the Subletting and Subcontracting Fair Practices Act (chapter 4 (commencing at Section 4100), part 1, division 2 of the Public Contract Code of the State of California) and any amendments thereof, each bidder shall set forth below: (a) the name, the location of the place of business, and the California contractor license number and (b) the portion of the work which will be done by each subcontractor who will perform work or labor or render service to the contractor in or about the construction of the work or improvement to be performed under this Contract or a subcontractor licensed by the State of California who, under subcontract to the contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications in an amount in excess of one-half (1/2) of one percent (1%) of the contractor's total bid or ten thousand dollars (\$10,000), whichever is greater. The contractor shall list only one subcontractor for each such portion as is defined by the contractor in this bid. An inadvertent error in listing the California contractor license number shall not be grounds for filing a bid protest or grounds for considering the bid nonresponsive if the corrected contractor's license number is submitted to the public entity by the prime contractor within 24 hours after the bid opening and provided the corrected contractor's license number corresponds to the submitted name and location for that subcontractor. No time extension will be allowed for submission of information required by this document.

If a contractor fails to specify a subcontractor or if a contractor specifies more than one subcontractor for the same portion of work to be performed under the Contract in excess of one-half (1/2) of one percent (1%) of the contractor's total bid, or ten thousand dollars (\$10,000), whichever is greater, he shall be deemed to have agreed that he is fully qualified to perform that portion himself, and that he shall perform that portion himself.

No contractor whose bid is accepted shall (a) substitute any subcontractor, (b) permit any subcontract to be voluntarily assigned or transferred or allow it to be performed by anyone other than the original subcontractor listed in the original bid, or (c) sublet or subcontract any portion of the work in excess of one-half of one percent of the contractor's total bid as to which his original bid did not designate a subcontractor, except as authorized in the Subletting and Subcontracting Fair Practices Act. Subletting or subcontracting of any portion of the work in excess of one-half of one percent of the contractor's total bid as to which no subcontractor was designated in the original bid shall only be permitted in cases of public emergency or necessity, and then only after a finding reduced to writing as a public record of the authority awarding this Contract setting forth the facts constituting the emergency or necessity.

Portion of Work	Subcontractor	Location of Business	Phone Number	License No. and Exp. Date

Portion of Work	Subcontractor	Location of Business	Phone Number	License No. and Exp. Date

 Proper Name of Bidder Address

 By (Print Name) Title

 Phone Date

END OF DOCUMENT

SECTION 00 4513
BIDDER'S QUALIFICATIONS

INFORMATION REQUIRED OF BIDDERS
COUNTY OF MADERA
200 West 4th Street, Madera CA 93637

Bidder references and responsibility information

1. The County expressly reserves the right to reject the bid of any bidder who, upon investigation, has been determined to fail to complete similar contracts in a timely fashion or in a satisfactory manner. Such rejection would, if applicable, be based upon the principle that the bidder is "non-responsible" and poses a substantial risk of being unable to complete the work in a cost-effective, professional, and timely manner.
2. In performing the above-described responsibility determination, the County reserves the right to utilize all possible sources of information in making its determination, including but not limited to inquiries to regulatory State Boards and agencies; Dun and Bradstreet credit reports, inquiries to companies and public entities for which the contractor has previously performed work, reference checks and examination of all public records.
3. The bidder must provide the following information:

a. Firm Name and Address:

—

—

—

b. Telephone: _____

c. Type of Firm: Individual _____
(Check one) Partnership _____
Corporation _____

d. Contractor's License: Primary Class _____ Lic. No. _____

License Expiration Date: _____

e. Names and titles of all officers of the firm:

—

—

f. Number of years as a contractor in construction of this type: _____

4. The bidder must also demonstrate knowledge of public construction techniques and should possess a working ability to perform similarly sized construction work for a public agency. This knowledge and ability shall be shown by furnishing the names, current phone numbers, and address, points of contract and scope of work of at least five (5) customers served within the past three (3) years with requirements similar to the needs of the County of Madera.

a. FAILURE TO FURNISH THE REFERENCES (IN THE COMPLETE FORMAT REQUIRED) MAY CAUSE YOUR BID TO BE REJECTED AS NONRESPONSIVE.

EXAMPLE: Your references should be listed in the following format (facts are example only)

- i. Work for X Y Z County
- ii. Phone # (222) 123-4567

- iii. 999 Holly Drive, L.A., CA 92000
- iv. Contact: J.Q. Jones III at above #
- v. Renovated Hills High in 1990 for \$1.3 Million.

Bidder's Name:	
<u>Reference #1</u>	
County or Entity:	
Phone #:	
Address:	
Name of Contact:	
Scope of Work & \$ Amount:	

Bidder's Name:	
<u>Reference #2</u>	
County or Entity:	
Phone #:	
Address:	
Name of Contact:	
Scope of Work & \$ Amount:	

Bidder's Name:	
<u>Reference #3</u>	
County or Entity:	
Phone #:	

Address:	
Name of Contact:	
Scope of Work & \$ Amount:	

Bidder's Name:	
<u>Reference #4</u>	
County or Entity:	
Phone #:	
Address:	
Name of Contact:	
Scope of Work & \$ Amount:	

Bidder's Name:	
<u>Reference #5</u>	
County or Entity:	
Phone #:	
Address:	
Name of Contact:	
Scope of Work & \$ Amount:	

END OF DOCUMENT

State of California)
) ss.
County of _____)

I certify (or declare) under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Print Name and Title

Notary Public In and for said County and State

00 45 19 - 1 of 1

SECTION 00 4526
CONTRACTOR'S CERTIFICATE REGARDING
WORKERS' COMPENSATION

Labor Code Section 3700 in relevant part provides:

Every employer except the State 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 satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to his employees

I am aware of the provisions of Section 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 such provisions before commencing the performance of the work of this Contract.

Contractor

By _____
Signature

Title _____

(In accordance with Article 5 (commencing at Section 1860), chapter 1, part 7, division 2 of the Labor Code, the above certificate must be signed and filed with the awarding body prior to performing any work under this Contract.)

END OF DOCUMENT

MADERA COUNTY CONTRACT NO. _____
(Madera County North Fork Branch Library Renovation)

THIS AGREEMENT is made and entered into this _____ day of _____, 2026, by and between the COUNTY OF MADERA, a political subdivision of the State of California ("COUNTY"), and _____, a California corporation ("CONTRACTOR").

AGREEMENT

1. **TERM.** CONTRACTOR's services under this Agreement shall be commenced on the date stated in the County's Notice to Proceed be completed by/within _____. In entering into this Contract, Contractor acknowledges and agrees that the construction duration stipulated herein is adequate and reasonable for the size and scope of the Project.
2. **SCOPE OF SERVICES.** CONTRACTOR's scope of services under this Agreement shall be as set forth perform in CONTRACTOR's Bid Form dated _____, and Request for Proposal (RFP) # _____, copies of which are attached hereto as Exhibits "A" and "B" and incorporated herein by reference.
3. **INCORPORATION OF MASTER AGREEMENT.** Madera County Master Contract No. 011 is incorporated herein by reference as if fully stated. CONTRACTOR shall adhere to all terms and conditions of Master Contract No. 011.
4. **COMPENSATION AND COSTS.** CONTRACTOR's total compensation for the satisfactory completion of services under this Agreement shall be the sum of _____ (\$_____).
5. **NOTICES.** All notices required by this Agreement shall be in writing and shall be effective upon personal service or deposit in the mail, postage prepaid and addressed as follows:

COUNTY

Joel Bugay
Madera County General Services
200 West Fourth Street
Madera, CA 93637

CONTRACTOR

Contractors Name
Company Name
Street
City, State, zip code

COPY TO:

Karen Scrivner, Clerk of the Board
Madera County Board of Supervisors
200 West Fourth Street
Madera, CA 93637

6. **INSURANCE.** CONTRACTOR shall not commence work under this Agreement until first obtaining general liability insurance in the amount of One Million Dollars (\$1,000,000.00) per occurrence and Two Million Dollars (\$2,000,000.00) aggregate; automotive insurance in the amount of One Million Dollar (\$1,000,000.00) per occurrence, combined single limits, including bodily injury and property damage; and workers' compensation insurance as required by California law. General liability policies shall name the County of Madera, its officers, employees, agents, and volunteers as additional insureds.

7. **BONDS.** CONTRACTOR shall comply with Section 33 of Madera County Master Agreement, contract Number 011.

8. **LIQUIDATED DAMAGES.** Liquidated Damages in the daily amount of two thousand dollars (\$2,000.00) per day shall apply pursuant to Section 35 of Madera County Master Agreement, Contract Number 011, and as provided in the General Conditions and Special Conditions.

9. **PREVAILING WAGES.** Contractor shall comply with the prevailing wage provisions of the Labor Code and the prevailing wage rate determinations of the Department of Industrial Relations. These rates are posted on the State of California Department of Industrial Relations website at www.dir.ca.gov. Copies may be obtained on request. A copy of these rates shall be posted at the job site. It shall be mandatory upon the Contractor and all subcontractors to comply with all Labor Code provisions, which include but are not limited to prevailing wages, employment of apprentices, hours of labor, and debarment of Contractors and subcontractors.

10. **DEPARTMENT OF INDUSTRIAL RELATIONS COMPLIANCE.** Contractor and any subcontractors shall be registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5. This Contract is subject to compliance monitoring and enforcement by the Department of Industrial Relations. Contractors must furnish electronic certified payroll records to the Labor Commissioner in the eCPR data system, or equivalent as authorized by the Labor Commissioner.

11. **COMPONENT PARTS OF THE CONTRACT.** The agreement entered into by this Contract consists of the following Contract Documents, all of which are component parts of the Contract as if herein set out in full or attached hereto:

Advertisement for Bids
Instructions to Bidders
Request for Clarification Form
Bid Form
Proposed Subcontractors Form
Bidder Qualification Form
Non-Collusion Affidavit
Contractor's Certification Regarding Workers Compensation
Contract
Bid Bond
Performance Bond
Payment Bond for Public Works
General Conditions
Supplementary Conditions
Insurance Policies
Addenda No. _____, _____, _____, _____, _____, as issued
Drawings, Plans, and Specifications.

All of the above-named Contract Documents are intended to be complementary. Work required by one of the above-named Contract Documents and not by others shall be done as if required by all. This Contract shall supersede any prior agreement of the parties.

//

* * * * *

IN WITNESS WHEREOF the foregoing Agreement is executed on the date and year first above-written.

COUNTY OF MADERA

ATTEST:

Clerk, Board of Supervisors

Chairman, Board of Supervisors

Approved as to Legal Form:
COUNTY COUNSEL

CONTRACTOR NAME

By: _____

By: _____
Signature

Print Name

ACCOUNT NUMBER(S)

SECTION 00 61 00
BID BOND

KNOW ALL MEN BY THESE PRESENTS: That we,

_____,
as Principal, and _____,
as Surety, are held and firmly bound unto the Madera County, hereinafter called the County, in the penal sum
_____ PERCENT (_____ %) OF THE TOTAL AMOUNT OF THE BID of the
Principal submitted to the said COUNTY for the work described below for the payment of which sum in lawful
money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators,
successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted the accompanying
bid dated _____, 20____, for _____.

NOW, THEREFORE. If the Principal shall not withdraw said bid within the period specified therein after the
opening of the same, or, if no period be specified, within sixty (60) days after said opening; and, if the Principal
be awarded the contract, and shall within the period specified therefore, or if no period be specified, within ten
(10) consecutive calendar days after the notification of Award of Contract complete the prescribed forms are
presented to him for signature enter into a written contract with the County in accordance with the bid as
accepted and give bond with good and sufficient surety or sureties, as may be required, for the faithful
performance and proper fulfillment of such contract and for the payment for labor and materials used for the
performance of the contract, or in the event of the withdrawal of said bid within the period specified or the failure
to enter into such contract and give such bonds within the time specified. If the Principal shall pay the County
the difference between the amount specified in said bid and the amount for which the County may procure the
required work and/or supplies, if the latter amount be in excess of the former, together with all costs incurred by
the County in again calling for bids, then the above obligation shall be void and of no effect, otherwise to remain
In full force and virtue.

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 call for bids, or to the 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 call for bids, or
to the work, or to the specifications.

In the event a lawsuit is brought upon this bond by the County and judgment is recovered, the surety shall pay
all litigation expenses incurred by the County in such suit, including reasonable attorneys' fees, court costs,
expert witness fees and investigation expenses.

IN WITNESS WHEREOF, the above-bound parties have executed this instrument under their several seals this
_____ day of _____, 20____, the name and corporate seal of each corporate party being hereto
affixed, and these presents duly assigned by its undersigned representative, pursuant to authority of Its
governing body.

(Corporate Seal)

Principal

By _____

Title: _____

(Corporate Seal)

Surety

By _____
Attorney-in-Fact

(Attach Attorney-in-Fact Certificate)

Title _____

END OF DOCUMENT

SECTION 00 61 13.13
PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS That

WHEREAS, the County of Madera (hereinafter designated as "Public Entity"), by action taken or a resolution passed, _____ 20____ has awarded to _____ hereinafter designated as the "Principal," a contract for work described as follows:

(the "Project"); and _____ (Contractor to Insert Project Title and Project #)
WHEREAS, said Principal is required under the terms of said contract to furnish a bond for the faithful performance of thereof;

NOW THEREFORE, we, the Principal and _____, as Surety, are held and firmly bound unto the Public Entity in the penal sum of _____ Dollars (\$_____) which is one hundred percent (100%) of the total contract amount for the above stated Project. lawful money of the United States of America, to be paid to the County for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that if the above bounded Principal, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by and well and truly keep and perform, the covenants, conditions, and agreements in the said contract and any alteration thereof made as therein provided, on his or their part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and save harmless the County, its officers and agents, as therein stipulated, then this obligation shall become null and void, otherwise, It shall be and remain in full force and virtue. And the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contractor to the work to be performed thereunder, or the specifications accompanying the same, shall in anywise affect its obligation on this bond, it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the contract, or to the work, or to the specifications. In the event suit is brought upon this bond by the County and judgment is recovered, the Surety shall pay all litigation expenses incurred by the County in such suit, including attorneys' fees, court costs, expert witness fees and investigation expenses.

IN WITNESS WHEREOF, two (2) identical counterparts of this instrument, each of which shall for all purposes be deemed an original thereof, have been duly executed by the Principal and Surety above named, on the day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

IN WITNESS WHEREOF, we have here to set our hands and seals this _____ day on _____, 20____.

(Corporate Seal of Principal if corporation)

Principal (Property Name of Contractor)

By _____

(Signature of Contractor)

(Seal of Surety)

Surety

By _____

Attorney in Fact

(Attached Attorney-in Fact Certificate and Required Acknowledgements)

*Note: Appropriate Notarial Acknowledgments of Execution by Contractor and surety and a power of Attorney MUST BE ATTACHED.

END OF DOCUMENT

SECTION 00 61 13.16
PAYMENT BOND FOR PUBLIC WORKS

KNOW ALL MEN BY THESE PRESENTS That

WHEREAS, the County of Madera (hereinafter designated as the "County"), by action taken or a resolution passed _____, 20____ has awarded to _____ hereinafter designated as the "Principal," a contract for the work described as follows:

(the "Project"); and _____. (Contractor to Insert Project Title and Project #) WHEREAS, said Principal is required to furnish a bond in connection with said contract; providing that if said Principal or any of its Subcontractors shall fail to pay for any materials, provisions, provender, equipment, or other supplies used in, upon, for or about the performance of the work contracted to be done, or for any work or labor done thereon of any kind, or for amounts due under the Unemployment Insurance Code or for any amounts required to be deducted, withheld, and paid over to the Employment Development Department from the wages of employees of said Principal and its Subcontractors with respect to such work or labor the Surety on this bond will pay for the same to the extent hereinafter set forth.

NOW THEREFORE, we, the Principal and _____ as Surety, are held and firmly bound unto the County in the penal sum of _____ Dollars (\$_____) lawful money of the United States of America, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that if said Principal, his or its subcontractors, heirs, executors, administrators, successors or assigns, shall fail to pay any of the persons named in Section 3181 of the Civil Code, fail to pay for any materials, provisions or other supplies, 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 amounts due under the Unemployment Insurance Code with respect to work or labor performed under the contract, or for any amounts required to be deducted, withheld, and paid over to the Employment Development Department or Franchise Tax Board from the wages of employees of the contractor and his subcontractors pursuant to section 18663 of the Revenue and Taxation Code, with respect to such work and labor the surety or sureties will pay for the same, in an amount not exceeding the sum herein above specified, and also, in case suit is brought upon this bond, all litigation expenses incurred by the Public Entity in such suit, including reasonable attorneys' fees, court costs, expert witness fees and investigation expenses.

This bond shall inure to the benefit of any of the persons named in Section 3181 of the Civil Code so as to give a right of action to such persons or their assigns in any suit brought upon this bond.

It is further stipulated and agreed that the Surety on this bond shall not be exonerated or released from the obligation of this bond by any change, extension of time for performance, addition, alteration or modification in, to, or of any contract, plans, specifications, or agreement pertaining or relating to any scheme or work of improvement herein above described, or pertaining or relating to the furnishing of labor, materials, or equipment therefore, nor by any change or modification of any terms of payment or extension of the time for any payment pertaining or relating to any scheme or work of improvement herein above described, nor by any rescission or attempted rescission or attempted rescission of the contract, agreement or bond, nor by any conditions precedent or subsequent in the bond attempting to limit the right of recovery of claimants otherwise entitled to recover under any such contract or agreement or under the bond, nor by any fraud practiced by any person other than the claimant seeking to recover on the bond and that this bond be construed most strongly against the Surety and in favor of all persons for whose benefit such bond is given, and under no circumstances shall Surety be released from liability to those for whose benefit such bond has been given, by reason of any breach

of contract between the owner or Public Entity and original contractor or on the part of any obligee named in such bond, but the sole conditions of recovery shall be that claimant is a person described in Section 3110 or 3112 of the Civil Code, and has not been paid the full amount of his claim and that Surety does hereby waive notice of any such change, extension of time, addition, alteration or modification herein mentioned.

IN WITNESS WHEREOF, two (2) identical counterparts of this instrument, each of which shall for all purposes be deemed unoriginal thereof, have been duly executed by the Principal and Surety above named, on the ____ day of _____, 20____ the name and corporate seal of each corporate party being hereto affixed and these IN WITNESS WHEREOF, we have here to set our hands and seals this ____ day on _____, 20____

(Corporate Seal of Principal if corporation) _____

Principal (Property Name of Contractor)

By _____

(Signature of Contractor)

(Seal of Surety)

Surety

By _____

Attorney in Fact

(Attached Attorney-in Fact Certificate and
Required Acknowledgements)

*Note: Appropriate Notarial Acknowledgments of Execution by Contractor and surety and a power of Attorney MUST BE ATTACHED.

END OF DOCUMENT

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ARTICLE 1. DEFINITIONS

- a. Acceptable, Acceptance or words of similar import are used, it shall be understood that the acceptance of the Construction Manager, Architect and/or the County is intended.
- b. Approval means written authorization by Construction Manager, Architect and/or County for specific applications within the Contract.
- c. Architect means the Architect employed by County to provide architecture and related services for the Project.
- d. Construction Manager means the Construction Manager employed by the County to provide construction management and related services for the Project.
- e. Contract, Contract Documents include all Contract Documents including: Advertisement for Bids, Instructions to Bidders, Bid Form, Proposed Subcontractors Form, Proposed Construction Schedule Form, Bidder's Qualifications, Non-Collusion Affidavit, Certificate Regarding Workers' Compensation, Performance Bond, Payment Bond for Public Works, Insurance Policies Documents, General Conditions, Supplementary Conditions, if any, Drawings, Plans, Specifications, the Contract, and all modifications, addenda, and amendments.
- f. Day as used herein shall mean calendar day unless otherwise specifically designated.
- g. County and Contractor are those mentioned as such in the Contract. For convenience and brevity, these terms, as well as terms identifying other persons involved in the Contract are treated throughout the Contract Documents as if they are of singular number and masculine gender. The Terms County and Owner are used interchangeably.
- h. County's Representative or Representative means any representative of the County authorized in writing to act on behalf of the County, including but not limited to the County's Architect, Inspector and/or Construction Manager.
- i. Equal, Equivalent, Satisfactory, Directed, Designated, Selected, As Required and words of similar meaning are used, the written approval, selection, satisfaction, direction, or similar action of the Construction Manager, Architect, and/or County is required.
- j. Includes and Including do not limit the work to the items following those words.
- k. Indicated, Shown, Detailed, Noted, Scheduled or words of similar meaning shall mean that reference is made to the drawings, unless otherwise noted. It shall be understood that the direction, designation, selection, or similar import of the Construction Manager, Architect, and/or County is intended, unless stated otherwise.
- l. Locality in which the work is performed means the county in which the public work is done.
- m. Perform shall be understood to mean that the Contractor, at Contractor's expense, shall perform all operations necessary to complete the work, including furnishing of necessary labor, tools, and equipment, and further including the furnishing and installing of materials that are indicated, specified, or required to complete such performance.
- n. Project is the undertaking planned by County and Contractor as provided in the Contract Documents.
- o. Provide shall include "provide complete in place," that is, "furnish, install, test and make ready for use."
- p. Required and words of similar meaning are used, it shall mean "as required to properly complete the work" as required by the Construction Manager, Architect and/or County, unless stated otherwise.
- q. Subcontractor as used herein, includes those having a direct contract with Contractor and one who furnishes material worked to a special design according to plans, drawings, and specifications of this work, but does not include one who merely furnishes material not so worked.
- r. Surety is the person, firm, or corporation, admitted as a California admitted surety, that executes as surety the Contractor's Performance Bond and Payment Bond for Public Works. Surety must be an admitted surety insurer pursuant to Code of Civil Procedure Section 995.120.
- s. The Work means the entire improvement proposed by the County to be constructed in whole, or in part, pursuant to the Contract Documents.
- t. Work means labor, equipment and materials incorporated in, or to be incorporated in the construction covered by the Contract Documents.
- u. Worker includes laborer, worker, or mechanic, and any supervisors thereto.

ARTICLE 2. DRAWINGS AND SPECIFICATIONS

- a. **Contract Documents.** Contract Documents are complementary, and what is called for by one shall be as binding as if called for by all. The intention of documents is to provide the County with complete and fully operational facilities as indicated and specified including all labor and materials, equipment, and transportation necessary for the proper execution of the work. Materials or work described in words which as applied have a well-known technical or trade meaning shall be deemed to refer to such recognized standards.
- b. **Interpretations.** Drawings and specifications are intended to be fully cooperative and to agree. However, if Contractor observes that drawings and specifications are in conflict, the Contractor shall promptly notify the Construction Manager in writing and any necessary changes shall be adjusted as provided in contracts for changes in work. If such conflict arises, the following order of precedence shall generally apply, provided, however, that the order of precedence shall not be so rigidly interpreted as to affect an absurd or costly result:
 - 1) Supplementary Conditions shall take precedence over General Conditions.
 - 2) Technical Specifications implement, in additional detail, the requirements of the General Conditions. In the event of conflict between the Technical Specifications and the General Conditions, the General Conditions shall take precedence.
 - 3) In the event of a conflict between the Technical Specifications and the drawings, the higher quality, higher quantity and the most stringent requirements shall be deemed to apply and shall govern as to materials, workmanship, and installation procedures.
 - 4) With regard to drawings:
 - (a) Figures govern over scaled dimensions;
 - (b) Larger scale drawings and details govern over smaller scale drawings;
 - (c) Addenda/change order drawings govern over Contract drawings;
 - (d) Contract drawings govern over standard drawings.
 - 5) Work not particularly shown or specified shall be the same as similar parts that are shown or specified.
- c. Misunderstanding of drawings and specifications shall be clarified by the Architect, whose decisions shall be final, and which shall be communicated to the Contractor by the Construction Manager.
- d. Standards, Rules, and Regulations referred to are recognized printed standards and shall be considered as one and a part of these specifications within limits specified.
- e. **Compliance with Applicable Laws.** Drawings and specifications are intended to comply with all laws, ordinances, rules, and regulations of authorities having jurisdiction, and where referred to in the Contract Documents, said laws, ordinances, rules, and regulations shall be considered as part of said Contract Documents within the limits specified. The Contractor shall bear all expenses correcting work done contrary to said laws, ordinances, rules, and regulations and if the Contractor (1) performed same without first consulting the Construction Manager for securing the Architect's instructions regarding said work or (2) disregarded the Architect's instructions regarding said work.
- f. **Provisions of Law Deemed Inserted.** Each and every provision of law required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if through mistake, omission or otherwise any such provision is not inserted, or is not correctly inserted, then upon application of either party the Contract shall be amended in writing to make such insertion or correction.
- g. **County's Authority.** The County retains the authority to issue the ultimate decision in the event the Construction Manager and Architect cannot reach a consensus regarding any clarification requested, any necessary changes to conflicting drawings and specifications, any requested instructions or any similar issue presented under this Article 2.
- h. **Organization of Work.** Organization of the specification into divisions, sections, and articles, and arrangement of drawings shall not control the Contractor in dividing the work among subcontractors or in establishing the extent of work to be performed by any trade.

ARTICLE 3. COPIES FURNISHED

Contractor will be furnished, free of charge, five copies of drawings and specifications as set forth in the Supplementary Conditions. Additional copies may be obtained at cost of reproduction.

ARTICLE 4. OWNERSHIP OF DRAWING

All drawings, specifications, and copies thereof furnished by the County are County property. They are not to be used by Contractor or Subcontractor on other work nor shall Contractor claim any right to such documents. With exception of one signed Contract set, all documents shall be returned to the County on request at completion of work.

ARTICLE 5. DETAIL DRAWINGS AND INSTRUCTIONS

- a. **Examination of Drawings and Specifications.** Before commencing any portion of the Work, Contractor shall carefully examine all Drawings and Specifications and other information given to Contractor as to materials and methods of construction and other Project requirements. Contractor shall immediately notify County and both the Construction Manager and Architect of any perceived or alleged error, inconsistency, ambiguity, or lack of detail or explanation in the Drawings and Specifications in the manner provided herein. If the Contractor or its Subcontractors, material or equipment suppliers, or any of their officers, agents and employees performs, permits, or causes the performance of any Work under the Contract Documents which it knows or should have known to be in error, inconsistent, or ambiguous, or not sufficiently detailed or explained, Contractor shall bear any and all costs arising therefrom including, without limitation, the cost of correction thereof without increase or adjustment to the Contract Price, as set forth in Article 3 of the Contract, or the time for performance. If Contractor performs, permits, or causes the performance of any Work under the Contract Documents prepared by or on behalf of Contractor which is in error, inconsistent or ambiguous, or not sufficiently detailed or explained, Contractor shall bear any and all resulting costs, including, without limitation, the cost of correction, without increase to or adjustment in the Contract Price or the time for performance. In no case shall any Subcontractor proceed with the Work if uncertain without the Contractor's written direction and/or approval.
- b. **Additional Instructions.** Within **ten (10) calendar days** of notification of any ambiguity, conflict or lack of information, the Construction Manager will provide Architect's prepared additional instructions, by means of drawings or other written direction, necessary for proper execution of work. All such drawings and instruments shall be consistent with the Contract Documents, true developments thereof, and reasonable inferable therefrom. Work shall be executed in conformity therewith and Contractor shall do no work without proper drawings and instructions. Any necessary additional details furnished by the Construction Manager and/or the Architect to more fully explain the work shall be considered as part of the Contract Documents.
- c. **Scale Drawings.** Should any details need to be more elaborate, in the opinion of the Contractor, than scale drawings and specifications warrant, written notice thereof shall be given to the Construction Manager within five (5) working days of the receipt of same. In case no notice is given to the Construction Manager within five (5) working days, it will be assumed the details are a reasonable development of the scale drawings. In case notice is given, then the Construction Manager and Architect, together, will consider the claim and if found justified, the drawings will be modified by the Architect, or Construction Manager shall recommend to the County a change order for the extra work involved within a reasonable amount of time.
- d. **Quality of Parts, Construction and Finish.** All parts of the described and shown construction shall be of the best quality of their respective kinds and the Contractor is hereby advised to use all diligence to inform himself fully as to the required construction and finish, and in no case to proceed with the different parts of the work without obtaining first from both the Construction Manager and Architect such directions and/or drawings as may be necessary for the proper performance of the work.
- e. **Contractor's Variation from Contract Document Requirements.** If it is found that the Contractor has varied from the drawings and/or specifications, in materials, quality, form or finish, or in the amount or value of the materials and labor used, the Construction Manager, shall be at liberty at any time, before or after completion of the work, to order such improper work removed, remade and replaced, and all work disturbed by these changes shall be made good at the Contractor's expense, or the Construction Manager, after consultation with the Architect, shall receive from the Contractor, for the County (or County shall deduct from amount due Contractor), a sum of money equivalent to the difference in value between the work performed and that called for by the drawings and specifications, it being optional with the Construction Manager and Architect to pursue either course.

ARTICLE 6. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

- a. **Time for Completion/Liquidated Damages.** Work shall be commenced on or before the date stated in the County's notice to the Contractor to proceed and shall be completed by Contractor in the time specified in the Supplementary Conditions. The County is under no obligation to consider early completion of the Project and the Contract completion date shall not be amended by the County's acceptance of the Contractor's proposed earlier completion date. Furthermore, Contractor shall not, under any circumstances receive additional compensation from the County for indirect, general, administrative or other forms of overhead costs for the period between the time of earlier completion proposed by the Contractor and the official

Contract completion date. If the work is not completed in accordance with the foregoing, it is understood that the County will suffer damage. It being impractical and infeasible to determine the amount of actual damage, it is agreed that Contractor shall pay to the County as fixed and liquidated damages, and not as a penalty, the sum stipulated in the Supplementary Conditions for each calendar day of delay until work is completed and accepted. Contractor and his surety shall be liable for the amount thereof. Any money due or to become due the Contractor may be retained to cover said liquidated damages. Should such money not be sufficient to cover said liquidated damages, the County shall have the right to recover the balance from the Contractor or his sureties, who will pay said balance forthwith. Regardless of the schedule submitted by Contractor, no delay claims shall be accepted by the County unless the event or occurrence delays the completion of the Project beyond the contractual completion date.

- b. **Inclement Weather.** Contractor shall abide by Construction Manager's determination of what constitutes inclement weather based upon the Inspector or geotechnical engineer's recommendation. A bad weather day is a day when the weather causes unsafe work conditions or is unsuitable for work that should not be performed during inclement weather (i.e., exterior finishes), and shall include consideration when rain days exceed the normal frequency and amount based on the closest weather station data averaged over the past three years, for the period of this Contract and when Contractor can show that such rain days impact the critical path. Time extensions shall only be granted when the work that is stopped during inclement weather is on the critical path of the Project schedule. Contractor shall be expected to perform all work he can possibly complete during inclement weather (i.e., interior work),
- c. **Extension of Time.** Contractor shall not be charged liquidated damages because of any delays in completion of work due to unforeseeable causes beyond the control and without the fault or negligence of Contractor including, but not restricted to: acts of God, or of public enemy, acts of Government, acts of County or anyone employed by him or acts of another Contractor in performance of a contract with the County, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather or delays of subcontractors due to such causes. Contractor shall within five (5) calendar days of the beginning of any such delay (unless the County grants a further period of time prior to date of final settlement of the Contract) notify the County in writing of causes of delay; thereupon the County shall ascertain the facts and extent of delay and grant extension of time for completing work when, in its judgment, the findings of fact justify such an extension. The County's findings of fact thereon shall be final and conclusive on parties hereto. In case of a continuing cause of delay, only one claim is necessary. Time extensions to the Project should be requested by the Contractor as they occur and without delay. Regardless of the schedule submitted by Contractor, no delay claims shall be accepted by the County unless the event or occurrence delays the completion of the Project beyond the contractual completion date.
- d. **No Damages for Delay.** the County's liability to Contractor for delays for which the County is responsible shall be limited to an extension of time for delays unless such delays were unreasonable under the circumstances involved and were not within the contemplation of the parties when the Contract was awarded. Contractor agrees that the Construction Manager shall determine the actual costs to Contractor of any delay for which Contractor may claim damages from the County. Such costs, if any, shall be directly related to the Project, and shall not include costs that would be borne by the Contractor in the regular course of business, including, but not limited to, home office overhead and ongoing insurance costs. The County shall not be liable for any damages which the Contractor could have avoided by any reasonable means including, but not limited to, the judicious handling of forces, equipment, or plant.

ARTICLE 7. REMOVAL OR RELOCATION OF MAIN OR TRUNKLINE UTILITY FACILITIES

- a. The County has endeavored to determine the existence of utilities at the site of the work from the records of the owners of known utilities in the vicinity of the work. The positions of these utilities as derived from such records are shown on the plans.
- b. No excavations were made to verify the locations shown for underground utilities. The service connections to these utilities are not shown on the plans. It shall be the responsibility of the Contractor to determine the exact location of all service connections. The Contractor shall make his own investigations, including exploratory excavations, to determine the locations and type of service connections, prior to commencing work which could result in damage to such utilities. The Contractor shall immediately notify the County's Representative as to any utility discovered by him in a different position than shown on the plans or which is not shown on the plans.

1) MAIN OR TRUNKLINE FACILITIES

- (a) Notwithstanding the above, pursuant to Section 4215 of the Government Code, as it may be amended from time to time, the County has the responsibility to identify, with reasonable accuracy, main or trunk line facilities on the plans and specifications. In the event that main or trunk line utility facilities are not identified with reasonable accuracy in the plans and specifications made a part of the invitation for bids, County shall assume the responsibility for their timely removal, relocation, or protection.

- (b) The Contractor shall be compensated by the County for the costs of locating and repairing damage not due to the failure of the Contractor to exercise reasonable care, and removing, relocating, protecting or temporarily maintaining such main or trunk line utility facilities not indicated with reasonable accuracy in the plans and specifications, and for equipment in the Project necessarily idled during such work. In this regard, Contractor will be required to do such work in accordance with Article 48 herein.
- (c) Alternatively, County may make changes in the alignment and grade of the work to obviate the necessity to remove, relocate, or temporarily maintain the utility, in accordance with Article 48 or County may make arrangements with the owner of the utility for such work to be done at no cost to the Contractor.
- (d) The Contractor shall not be assessed a forfeiture for delay in completion of the Project when such delay is caused by the failure of the County or the owner of the utility to provide for the removal, relocation, protection, or temporary maintenance of all such main or trunk line facilities not indicated with reasonable accuracy.
- (e) Nothing herein shall preclude the County from pursuing any appropriate remedy against the utility for delays which are the responsibility of the utility.
- (f) Nothing herein shall be construed to relieve the utility from any obligation as required either by law or by contract to pay the cost of removal or relocation of existing utility facilities.
- (g) If the Contractor while performing the Contract discovers utility facilities not identified by the County in the Contract plans or specifications, he shall immediately notify the County and utility in writing.
- (h) The owner of the public utility shall have the sole discretion to perform repairs or relocation work or hire the Contractor to do such repairs or relocation work at a reasonable price.

2) OTHER UTILITIES

- (a) In case it should be necessary to remove, relocate, or temporarily maintain a utility because of interference with the work, the work on the utility shall be performed and paid for as follows:
 - i. When it is necessary to remove, relocate or temporarily maintain a service connection, the cost of which is not required to be borne by the owner thereof, the Contractor shall bear all expenses incidental to the work on the service connection. The work on the service connection shall be done in a manner satisfactory to the owner thereof; it being understood that the owner of the service connection has the option of doing such work with his own forces or permitting the work to be done by the Contractor.
 - ii. When it is necessary to remove, relocate, or temporarily maintain a utility which is in the position shown on the plans, the cost of which is not required to be borne by the owner thereof, the Contractor shall bear all expenses incidental to the work on the utility. The work on the utility shall be done in a manner satisfactory to the owner thereof; it being understood that the owner of the utility has the option of doing such work with his own forces or permitting the work to be done by the Contractor.
 - iii. When it is necessary to remove, relocate, or temporarily maintain a utility which is not shown on the plans or is in a position different from that shown on the plans and were it in the position shown on the plans would not need to be removed, relocated, or temporarily maintained, and the cost of which is not required to be borne by the owner thereof, the County will make arrangements with the owner of the utility for such work to be done at no cost to the Contractor, or will require the Contractor to do such work in accordance with Article 48 or will make changes in the alignment and grade of the work to obviate the necessity to remove, relocate, or temporarily maintain the utility. Changes in alignment and grade will be ordered in accordance with Article 48 herein.
 - iv. No representations are made that the obligations to move or temporarily maintain any utility and to pay the cost thereof is or is not required to be borne by the owner of such utility, and it shall be the responsibility of the Contractor to investigate to find out whether or not said cost is required to be borne by the owner of the utility.
 - v. The right is reserved to governmental agencies and to owners of utilities to enter at any time upon any street, alley, right-of-way, or easement for the purpose of making

changes in their property made necessary by the work and for the purpose of maintaining and making repairs to their property.

ARTICLE 8. PROGRESS SCHEDULE

- a. **Estimated Schedule.** Within **fourteen (14) calendar days** after the effective date of the Notice to Proceed, Contractor shall prepare an estimated progress schedule and shall submit same to County Construction Manager for approval. The schedule shall clearly identify all staffing and other resources which in the Contractor's judgment are needed to complete the Project within the time specified for completion. The schedule shall include milestones and shall include the "critical path" of construction. Such schedule shall be submitted to County, Construction Manager and Architect for the County's approval. The Contractor is fully responsible to determine and provide for any and all staffing and resources at levels which allow for good quality and timely completion of the Project; the County's approval of the progress schedule does not relieve the Contractor of any such responsibility. Contractor's failure to incorporate all elements of work required for the performance of the Contract or any inaccuracy in the schedule shall not excuse the Contractor from performing all work required for a completed Project within the specified Contract time period, notwithstanding the County's acceptance of the schedule. If the required schedule is not received by the time the first payment request is due, Contractor shall not be paid until the schedule is received, reviewed, and accepted by the County.
- b. **Schedule Contents.** The schedule shall allow enough time for inclement weather. Such schedule shall indicate graphically the beginning and completion dates of all phases of construction, shall indicate the critical path for all critical, sequential time related activities. All required schedules shall indicate "float time" for all "slack" or "gaps" in the non-critical activities. Submitted construction schedules shall have duration to match the Contract time. Excess time may be picked up with "float time" if needed or desired by the Contractor. A "bar chart" in reasonably complete detail shall be adequate in contracts over \$1 million and shall show critical path items. All required schedules shall be periodically updated to reflect changes in the status of the job, including weather delays. At a minimum, the Contractor shall be required to provide and keep updated a monthly schedule in order to prevent delay claims.
- c. **State Testing.** In no event shall Contractor conduct any work on the Project on dates on which State Testing of Pupils is conducted. County or County's Representative will provide Contractor with a schedule of test dates concurrent with the County's issuance of notice of award of Contract, or as soon as such test dates are made available to the County.

ARTICLE 9. CONTRACT SECURITY

Unless otherwise specified in Supplementary Conditions, Contractor shall furnish a surety bond in an amount equal to one hundred percent (100%) of Contract Price as security for faithful performance of this Contract and shall furnish a separate bond in an amount at least equal to one hundred percent (100%) of the Contract Price as security for payment of persons performing labor and furnishing materials in connection with this Contract. Both the Payment and Performance Bonds must be executed by an admitted Surety, as defined in Code of Civil Procedure Section 995.120. The Payment and Performance Bonds must be accompanied by the original or a certified copy of the unrevoked power of attorney or other appropriate instrument entitling or authorizing the person who executed the bond to do so. In addition, to the extent required by law, the Payment and Performance Bonds must be accompanied by a certified copy of the certificate of authority of the insurer issued by the Insurance Commissioner of the State of California, a certificate from the Clerk of the County of Madera that the certificate of authority of the insurer has not been surrendered, revoked, cancelled, annulled, or suspended, or if it has that it has been renewed, and four copies of the insurer's most recent annual statement and quarterly statement filed with the Department of Insurance of the State of California. Aforesaid bonds shall be in form set forth in these Contract Documents. Upon request of Contractor, the County will consider and accepting multiple sureties on such bonds.

ARTICLE 10. ASSIGNMENT

Contractor shall not assign, transfer, convey, sublet, or otherwise dispose of this Contract or any part thereof including any claims, without prior written consent of the County. Any assignment without the written consent of the County shall be void. Any assignment of money due or to become due under this Contract shall be subject to a prior lien for services rendered or material supplied for performance of work called for under said Contract in favor of all persons, firms, or corporations rendering such services or supplying such materials to the extent that claims are filed pursuant to the Civil Code, the Code of Civil Procedure, and/or the Government Code.

ARTICLE 11. CHANGE IN NAME AND NATURE OF CONTRACTOR'S LEGAL ENTITY

Should a change be contemplated in the name or nature of the Contractor's legal entity, the Contractor shall first notify the County in order that proper steps may be taken to have the change reflected on the Contract.

ARTICLE 12. PROHIBITED INTERESTS

No official of the County, and no County Representative who is authorized in such capacity and on behalf of the County to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with construction of the Project, shall be or become directly or indirectly interested financially in this Contract or in any part thereof. No officer, employee, Construction Manager, Architect, attorney, engineer or Inspector of or for the County who is authorized in such capacity and on behalf of the County to exercise any executive, supervisory or other similar functions in connection with construction of the Project, shall become directly or indirectly interested financially in this Contract or in any part thereof.

ARTICLE 13. SEPARATE CONTRACTS

- a. The County reserves the right to let other contracts in connection with this work. Contractor shall afford other contractors reasonable opportunity for introduction and storage of their materials and execution of their work and shall properly connect and coordinate his work with theirs.
- b. If any part of Contractor's work depends for proper execution or results upon work of any other contractor, the Contractor shall inspect and promptly report to the Construction Manager any defects in such work that renders it unsuitable for such proper execution and results. His failure so to inspect and report shall constitute his acceptance of other contractor's work as fit and proper for reception of his work, except as to defects which may develop in the other contractor's work after execution of contractor's work.
- c. To insure proper execution of his subsequent work, Contractor shall measure and inspect work already in place and shall at once report to the Construction Manager any discrepancy between executed work and the Contract Documents.
- d. Contractor shall ascertain to his own satisfaction the scope of the Project and nature of any other contracts that have been or may be awarded by the County in prosecution of the Project to the end that Contractor may perform this Contract in the light of such other contracts, if any. Nothing herein contained shall be interpreted as granting to Contractor exclusive occupancy at site of the Project. Contractor shall not cause any unnecessary hindrance or delay to any other contractor working on the Project. If simultaneous execution of any contract for the Project is likely to cause interference with performance of some other contract or contracts, the County or County's Representative shall decide which Contractor shall cease work temporarily and which contractor shall continue or whether work can be coordinated so that contractors may proceed simultaneously. The County shall not be responsible for any damages suffered or for extra costs incurred by Contractor resulting directly or indirectly from award, performance, or attempted performance of any other contract or contracts on the Project or caused by any decision or omission of the County or County's Representative respecting the order of precedence in performance of contracts.

ARTICLE 14. SUBCONTRACTING

- a. Contractor agrees to bind every subcontractor by terms of the Contract as far as such terms are applicable to subcontractor's work. If Contractor subcontracts any part of this Contract, Contractor shall be as fully responsible to the County for the acts and omissions of his subcontractor and of persons either directly or indirectly employed by his subcontractor, as he is for acts and omissions of persons directly employed by himself. Nothing contained in these Contract Documents shall create any contractual relation between any subcontractor and the County. The County shall be deemed to be the third-party beneficiary of the contract between the Contractor and the subcontractor.
- b. The County's consent to or approval of any subcontractor under this Contract shall not in any way relieve Contractor of his obligations under this Contract and no such consent or approval shall be deemed to waive any provision of this Contract
- c. Substitution or addition of subcontractors shall be permitted only as authorized in chapter 4 (commencing at Section 4100), part 1, division 2 of the Public Contract Code.

ARTICLE 15. COUNTY'S RIGHT TO TERMINATE CONTRACT

- a. The County may, without prejudice to any other right or remedy, serve written notice upon Contractor and his surety of its intention to terminate this Contract if the Contractor (i) refuses or fails to prosecute the work or any separable part thereof with such diligence as will insure its completion within the time specified or any extension thereof, or (ii) fails to complete said work within such time, or (iii) if the Contractor should file a bankruptcy petition or be adjudged a bankrupt, or (iv) if he should make a general assignment for the benefit of his creditors, or (v) if a receiver should be appointed on account of his insolvency, or (vi) if he should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled workers or proper materials to complete the work in time specified, or (vii) if he should fail to make prompt payment to subcontractors or for material or labor, or (viii) persistently disregard laws, ordinances or instructions of the County or those of County's Representatives, or (ix) otherwise be guilty of substantial violation of any provision of the Contract, or (x) if he or his subcontractors should violate any

of the provisions of this Contract. The notice of intent to terminate shall contain the reasons for such intention to terminate. Unless within ten (10) calendar days after the service of such notice, such condition shall cease or such violation shall cease and satisfactory arrangements for the correction thereof be made, this Contract shall, upon the expiration of said ten (10) calendar days, cease and terminate. In such case, Contractor shall not be entitled to receive any further payment until work is finished. In event of any such termination, the County shall immediately serve written notice thereof upon surety and Contractor written notice of termination stating that the contract has ceased and is terminated. Surety shall have the right to investigate, take over and perform this Contract, provided, however, that if Surety, within fifteen (15) calendar days after service upon it of said notice of termination, does not give the County written notice of its intention to take over and perform this Contract and does not commence performance thereof within twenty (20) calendar days from the date of service upon it of such notice of termination, the County may take over the work and prosecute same to completion by contract or by any other method it may deem advisable for the account and at the expense of Contractor. Contractor and his surety shall be liable to the County for any excess cost or other damages occasioned the County thereby. If the County takes over the work as herein above provided, the County may, without liability for so doing, take possession of and utilize in completing the work such materials, appliances, plant, and other property belonging to the Contractor as may be on the site of the work and necessary therefore. If Surety does not perform the Project work itself, the Surety shall consult with the County regarding its planned choice of a contractor or contractors to complete the Project, and upon request by County, Surety shall provide County evidence of responsibility of Surety's proposed contractor or contractors. County shall be entitled to reject Surety's choice of contractor or contractors if County determines in its sole discretion that the contractor or contractors are not responsible. If Surety provides County written notice of its intention to take over and perform this Contract, within fifteen (15) calendar days of such written notice of intent to take over and perform, Surety or its chosen contractor or contractors (if such contractor or contractors are approved by County) shall provide County a detailed Progress Schedule as specified in Article 8 above. Contractor and his surety shall be liable to County for any excess cost or other damages occasioned the County as a result of Surety or Surety's contractor or contractors takeover and performance.

- b. If the unpaid balance of the Contract Price exceeds the expense of finishing work, including compensation for additional architectural, managerial, and administrative services, such excess shall be paid to Contractor. If such expense shall exceed such unpaid balance, Contractor shall pay the difference to the County. Expense incurred by the County as herein provided, and damage incurred through Contractor's default, shall be certified by the Construction Manager.
- c. Should the County determine that environmental considerations mandate that the underlying Project should not go forward, County may notify Contractor that this Contract is terminated due to environmental considerations and County shall only be obligated to pay Contractor for the work that Contractor had performed at the time of notification of termination of this Contract for environmental considerations.
- d. Termination For Convenience: The County may terminate performance of the work called for by the Contract Documents in whole or, from time to time, in part, if the County determines that a termination is in the County's interest. The Contractor shall terminate all or any part of the Work upon delivery to the Contractor of a Notice of Termination specifying that the termination is for the convenience of the County, the extent of termination, and the effective Date of such termination. After receipt of Notice of Termination, and except as directed by the County, the Contractor shall, regardless of any delay in determining or adjusting any amounts due under this Termination for Convenience clause, immediately proceed with the following obligations:
 - 1) Stop Work as specified in the Notice.
 - 2) Complete any Work specified in the Notice of Termination in a least cost/shortest time manner while still maintaining the quality called for under the Contract Documents.
 - 3) Leave the property upon which the Contractor was working and upon which the facility (or facilities) forming the basis of the Contract Documents is situated in a safe and sanitary manner such that it does not pose any threat to the public health or safety.
 - 4) Terminate all subcontracts to the extent that they relate to the portions of the work terminated.
 - 5) Place no further subcontracts or orders, except as necessary to complete the continued portion of the Contract.
 - 6) Submit to the County, within ten (10) calendar days from the Effective Date of the Notice of Termination, all of the usual documentation called for by the Contract Documents to substantiate all costs incurred by the Contractor for labor, materials and equipment through the Effective Date of the Notice of Termination. Any documentation substantiating costs incurred by the Contractor solely as a result of the County's exercise of its right to terminate this Contract pursuant to this clause, which costs the Contractor is authorized under the Contract Documents to incur, shall: (i) be submitted to and received by the County no later than thirty (30) calendar days after the Effective Date of the Notice of Termination; (ii) describe the costs incurred with particularity; and (iii) be conspicuously

identified as "Termination Costs occasioned by the County's Termination for Convenience." Termination of the Contract shall not relieve Surety of its obligation for any just claims arising out of or relating to the Work performed. In the event that the County exercises its right to terminate this Contract pursuant to this provision, the County shall pay the Contractor, upon the Contractor's submission of the documentation required by this clause and other applicable provisions of the Contract Documents, all actual reimbursable costs incurred according to the provisions of this Contract.

- e. Termination of Contract by Contractor: The Contractor may terminate the Contract upon ten (10) calendar days written notice to the County, whenever: (1) the entire Work has been suspended for ninety (90) consecutive days through no fault or negligence of the Contractor, and notice to resume the Work or to terminate the Contract has not been received from the County within this time period; or (2) the County should fail to pay the Contractor any substantial sums due it in accordance with the terms of the Contract and within the time limits prescribed. In the event of such termination, the Contractor shall have no claims against the County except for Work performed as of the date of termination.
- f. The foregoing provisions are in addition to and not in limitation of any other rights or remedies available to the County.
- g. Notwithstanding the foregoing provisions, this Contract may not be terminated or modified where a trustee-in-bankruptcy has assumed the Contract pursuant to 11 U.S.C. Section 365 (Federal Bankruptcy Act).

ARTICLE 16. GUARANTEE

- a. Besides guarantees required elsewhere, Contractor shall, and hereby does, guarantee all work for a period of one (1) year after date of acceptance of work by the County. Contractor shall repair or replace any or all such work, together with any other work, which may be displaced in so doing, that may prove defective in workmanship and/or materials within a two-year period from date of acceptance without expense whatsoever to the County, ordinary wear and tear, unusual abuse or neglect excepted. The County will give notice of observed defects with reasonable promptness. Contractor shall notify the County upon completion of repairs.
- b. In the event of failure of Contractor to comply with above-mentioned conditions within one week after being notified in writing, the County is hereby authorized to proceed to have defects repaired and made good at the expense of Contractor. Contractor hereby agrees to pay costs and charges therefor immediately on demand.
- c. If, in the opinion of the County or County's Representative, defective work creates a dangerous condition or requires immediate correction or attention to prevent further loss to the County or to prevent interruption of operations of the County, the County or the County's Representative will attempt to give the notice required by this Article. If the Contractor cannot be contacted or does not comply with the County's request for correction within a reasonable time as determined by the County, the County may, notwithstanding the provisions of this Article, proceed to make such correction or provide such attention. The costs of such correction or attention shall be charged against the Contractor. Such action by the County or its Representative will not relieve the Contractor of the guarantees provided in this Article or elsewhere in this Contract.
- d. This Article does not in any way limit the guarantee on any items for which a longer guarantee is specified or on any items for which a manufacturer gives a guarantee for a longer period. Contractor shall furnish the County with all appropriate guarantee or warranty certificates upon completion of the Project.

ARTICLE 17. NOTICE AND SERVICE THEREOF

- a. Any notice from one party to the other under the Contract shall be in writing and shall be dated and signed by party giving such notice or by the duly authorized representative of such party. Any such notice shall not be effective for any purpose whatsoever unless served in one of the following manners:
 - 1) If notice is given to the County, by personal delivery thereof to the Construction Manager or the County or by depositing same in United States mails, enclosed in a sealed envelope addressed to the County and for attention of the Construction Manager, postage prepaid and registered;
 - 2) If notice is given to Contractor by personal delivery thereof to said Contractor or to his foreman at site of Project, or by depositing same in United States mails, enclosed in a sealed envelope addressed to said Contractor at his regular place of business or at such other address as may have been established for the conduct of work under this Contract, postage prepaid and registered;
 - 3) If notice is given to surety or other person by personal delivery to such surety or other person or by depositing same in United States mails, enclosed in a sealed envelope addressed to such surety or person at the address of such surety or person last communicated by him to party giving notice, postage prepaid and registered.
 - 4) If notice is served by mail, it shall be deemed received and all time periods associated with the giving of notice shall run from the third day after mailing.

ARTICLE 18. WORKERS

- a. Contractor shall at all times enforce strict discipline and good order among his employees. Contractor shall not employ on work any unfit person or any one not skilled in work assigned to him.
- b. Any person in the employ of the Contractor whom the County or County's Representative may deem incompetent or unfit shall be dismissed from work and shall not again be employed on it except with the written consent of the County.

ARTICLE 19. PREVAILING RATES OF WAGES

- a. The Contractor is aware of the requirements of Labor Code Sections 1720 et seq. and 1770 et seq., as well as California Code of Regulations, Title 8, Section 16000 et seq. ("Prevailing Wage Laws"), which require the payment of prevailing wage rates and the performance of other requirements on certain "public works" and "maintenance" projects. Since this Project involves an applicable "public works" or "maintenance" project, as defined by the Prevailing Wage Laws, and since the total compensation is \$1,000 or more, Contractor agrees to fully comply with such Prevailing Wage Laws. The Contractor shall obtain a copy of the prevailing rates of per diem wages at the commencement of this Agreement from the website of the Division of Labor Statistics and Research of the Department of Industrial Relations located at www.dir.ca.gov/dlsr/. In the alternative, the Contractor may view a copy of the prevailing rates of per diem wages at the County's Facilities Department. Contractor shall make copies of the prevailing rates of per diem wages for each craft, classification or type of worker needed to perform work on the Project available to interested parties upon request and shall post copies at the Contractor's principal place of business and at the Project site. Contractor shall defend, indemnify, and hold the County, its elected officials, officers, employees and agents free and harmless from any claims, liabilities, costs, penalties or interest arising out of any failure or alleged failure to comply with the Prevailing Wage Laws.
- b. The Contractor and each subcontractor shall forfeit as a penalty to the County not more than fifty dollars (\$50) for each calendar day, or portion thereof, for each worker paid less than the stipulated prevailing wage rate for any work done by him, or by any subcontract under him, in violation of the provisions of the Labor Code. The difference between such stipulated prevailing wage rate and the amount paid to each worker for each calendar day or portion thereof for which each worker was paid less than the stipulated prevailing wage rate shall be paid to each worker by the Contractor.
- c. As a further material part of this Contract, Consultant agrees to hold harmless and indemnify the County, its Board and each member of the Board, its officers, employees, and agents from any and all claims, liability, loss, costs, damages, expenses, fines and penalties, of whatever kind or nature, including all costs of defense and attorneys' fees, arising from any alleged failure of Contractor or its subcontractors to comply with the prevailing wage laws of the State of California. If the County or any of the indemnified parties are named as a party in any dispute arising from the failure of Contractor or its subcontractors to pay prevailing wages, Contractor agrees that the County and the other indemnified parties may appoint their own independent counsel, and Contractor agrees to pay all attorneys' fees and defense costs of the County and the other indemnified parties as billed, in addition to all other damages, fines, penalties and losses incurred by the County and the other indemnified parties as a result of the action.
- d. Contractor shall post, at appropriate conspicuous points on the site of the Project, a schedule showing all determined general prevailing wage rates and all authorized deductions, if any, from unpaid wages actually earned.

ARTICLE 20. PAYROLL RECORDS

- a. Pursuant to Labor Code Section 1776, as amended from time to time, the Contractor and each subcontractor shall maintain weekly certified payroll records showing the name, address, social security number, work classification, straight time and overtime hours paid each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the work. Contractor shall certify under penalty of perjury that records maintained and submitted by Contractor are true and accurate. Contractor shall also require subcontractor(s) to certify weekly payroll records under penalty of perjury.
- b. The payroll records enumerated under Article 21(a) above shall be certified and submitted by the Contractor at a time designated by the County. The Contractor shall also provide the following:
 - 1) A certified copy of the employee's payroll records shall be made available for inspection or furnished to such employee or his or her authorized representative on request.
 - 2) A certified copy of all payroll records enumerated in Article 21(a) shall be made available for inspection or furnished upon request of the Department of Industrial Relations ("DIR").
- c. The certified payroll records shall be on forms provided by the Division of Labor Standards Enforcement ("DLSE") of the DIR or shall contain the same information as the forms provided by the DLSE.

- d. Any copy of records made available for inspection and furnished upon request to the public 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 Contractor or any subcontractor performing Work on the Project shall not be marked or obliterated.
- e. In the event of noncompliance with the requirements of this Section, the Contractor shall have ten (10) days in which to comply subsequent to receipt of written notice specifying item or actions necessary to ensure compliance with this section. Should noncompliance still be evident after such ten (10) day period, the Contractor shall, as a penalty to the County, forfeit Twenty-five Dollars (\$25.00) for each calendar day, or portion thereof, for each worker until strict compliance is effectuated. Upon the request of the DIR, such penalties shall be withheld from contract payments.

ARTICLE 21. EMPLOYMENT OF APPRENTICES

- a. The Contractor's attention is directed to the provisions of Sections 1777.5, 1777.6, and 1777.7 of the Labor Code concerning employment of apprentices by the Contractor or any subcontractor under him. The Contractor shall obtain a certificate of apprenticeship before employing any apprentice pursuant to Section 1777.5, 1777.6, and 1777.7 of the Labor Code.
- b. Information relative to apprenticeship standards, wage schedules, and other requirements may be obtained from the Director of Industrial Relations, ex officio the Administrator of Apprenticeship, San Francisco, California, or from the Division of Apprenticeship Standards and its branch offices.
- c. Knowing violations of Section 1777.5 will result in forfeiture not to exceed \$100 for each calendar day of non-compliance pursuant to Section 1777.7.

ARTICLE 22. HOURS OF WORK

- a. Eight (8) hours of work shall constitute a legal day's work. The Contractor and each subcontractor shall forfeit, as penalty to the County, twenty-five dollars (\$25) for each worker employed in the execution of work on the Project by the Contractor or any subcontractor under him for each calendar day during which such worker is required or permitted to work more than eight (8) hours in any one calendar day and forty (40) hours in any calendar week in violation of the provisions of the Labor Code, and in particular, Section 1810 to Section 1815, thereof, inclusive, except that work performed by employees of the Contractor and his subcontractors in excess of eight hours per day at not less than one and one-half times the basic rate of pay, as provided in Labor Code Section 1815.
- b. Generally, construction work on the Project shall be accomplished on a regularly scheduled eight (8) hour per day work shift basis, Monday through Friday, between the hours of 7:00 a.m. and 5:00 p.m., however nothing herein shall prevent Contractor from working weekends and after hours in order to complete the Project so long as not otherwise prohibited by law or local ordinances or regulations.

ARTICLE 23. DEBARMENT OF CONTRACTORS AND SUBCONTRACTORS

The Contractor, or any subcontractor working under the Contractor, may not perform work on a public works project with a subcontractor who is ineligible to perform work on a public project pursuant to Section 1777.1 or Section 1777.7 of the Labor Code. Any contract on a public works project entered into between the Contractor and a debarred subcontractor is void as a matter of law. A debarred subcontractor may not receive any public money for performing work as a subcontractor on a public works contract. Any public money that is paid or may have been paid to a debarred subcontractor by the Contractor on the project shall be returned to the County. The Contractor shall be responsible for the payment of wages to workers of a debarred subcontractor who has been allowed to work on the project.

ARTICLE 24. NON-DISCRIMINATION

Pursuant to the provisions of Labor Code Section 1735, Contractor and its subcontractor shall not unlawfully discriminate in the employment of persons on this Project because of race, religious creed, color, national origin, ancestry, physical handicap, medical condition, marital status, and sex.

ARTICLE 25. WORKERS' COMPENSATION INSURANCE

The Contractor shall provide, during the life of this Contract, workers' compensation insurance for all of the employees engaged in work under this Contract, on or at the site of the Project, and, in case any of his work is sublet, the Contractor shall require the subcontractor similarly to provide workers' compensation insurance for all the latter's employees. Any class of employee or employees not covered by a subcontractor's insurance shall be covered by the Contractor's insurance. In case any class of employees engaged in work under this Contract, on or at the site of the Project, is not protected under the Workers' Compensation Statutes, the Contractor shall provide or shall cause a subcontractor to provide, adequate insurance coverage for the protection of such employees not otherwise protected. The Contractor is required to secure payment of compensation to his employees in accordance with the provisions of Section 3700 of the Labor Code. The Contractor shall file with the County certificates of his insurance protecting

workers. Company or companies providing insurance coverage shall be acceptable to the County, if in the form and coverage as set forth in Article 30.

ARTICLE 26. EMPLOYER'S LIABILITY INSURANCE

Contractor shall provide during the life of this Contract, Employer's Liability Insurance in the amount of, at least, one million dollars (\$1,000,000.00) per accident for bodily injury and disease. Contractor shall provide County with a certificate of Employer's Liability Insurance. Such insurance shall comply with the provisions of Article 30 below.

ARTICLE 27. COMMERCIAL GENERAL LIABILITY AND PROPERTY DAMAGE INSURANCE

- a. Contractor shall procure and maintain during the life of this Contract and for such other period as may be required herein, at its sole expense, such comprehensive general liability insurance or commercial general liability and property damage insurance as shall protect Contractor and the County, the County's Representatives and Agents, from all claims for bodily (personal) injury, including accidental death, as well as claims for property damage arising from operations under this Contract, and other covered loss, however occasioned, occurring during the policy term. Such policy shall comply with all the requirements of this Article and shall be in the form and amounts as set forth in the Supplementary Conditions hereof. The limits set forth in the Supplementary Conditions shall apply separately to each insured against whom claims are made or suits are brought, except with respect to the limits of liability. Further the limits set forth in the Supplementary Conditions shall not be construed to relieve the Contractor from liability in excess of such coverage, nor shall it limit Contractor's indemnification obligations to the County and shall not preclude the County from taking such other actions available to the County under other provisions of the Contract Documents or law.
- b. Contractor shall make certain that any and all subcontractors hired by Contractor are insured in accordance with this Contract. If any subcontractor's coverage does not comply with the foregoing provisions, Contractor shall indemnify and hold the County harmless from any damage, loss, cost, or expense, including attorneys' fees, incurred by the County as a result thereof.
- c. Company or companies providing insurance coverage shall be acceptable to the County and authorized to conduct business in the State of California. d. All general liability policies provided pursuant to the provisions of this Article shall comply with the provisions of Article 30 below.
- e. All general liability policies shall be written to apply to all bodily injury, including death, property damage, personal injury, owned and non-owned equipment, blanket contractual liability, completed operations liability, explosion, collapse, under-ground excavation, removal of lateral support, and other covered loss, however occasioned, occurring during the policy term, and shall specifically insure the performance by Contractor of that part of the indemnification contained in Article 31 hereof, relating to liability for injury to or death of persons and damage to property. If the coverage contains one or more aggregate limits, a minimum of 50% of any such aggregate limit must remain available at all times; if over 50% of any aggregate limit has been paid or reserved, the County may require additional coverage to be purchased by Contractor to restore the required limits. Contractor may combine primary, umbrella, and as broad as possible excess liability coverage to achieve the total limits indicated above. Any umbrella or excess liability policy shall include the additional insured endorsement described in Article 30 below.

ARTICLE 28. AUTOMOBILE LIABILITY INSURANCE

Contractor shall take out and maintain at all times during the term of this Contract Automobile Liability Insurance in the amount set forth in the Supplementary Conditions. Such insurance shall provide coverage for bodily injury and property damage including coverage for non-owned and hired vehicles, in a form and with insurance companies acceptable to the County. Such insurance shall comply with the provisions of Article 31 below.

ARTICLE 29. BUILDER'S RISK [FIRE; "ALL RISK"]

PROPERTY IN COURSE OF CONSTRUCTION: County is automatically covered under its existing Memorandum of Property coverage subject to the following exceptions:

Contractor's equipment is excluded under this course of extension.

ARTICLE 30. PROOF OF CARRIAGE OF INSURANCE

- a. Contractor shall, as soon as practicable following the placement of insurance required hereunder, but in no event later than the effective date of the Contract, deliver to the County certificates of insurance evidencing the same, together with appropriate separate endorsements thereto, evidencing that Contractor has obtained such coverage for the period of the Contract. Contractor shall deliver certified copies of the actual insurance policies specified herein, within thirty days after commencement of work. Thereafter, copies of renewal policies, or certificates and appropriate separate endorsements thereof, shall be delivered to the County within thirty (30) calendar days prior to the expiration of the term of any policy required herein. Contractor shall permit the County at all reasonable times to inspect any policies of insurance of Contractor which Contractor has not delivered to the County.

- b. Certificates and insurance policies shall include the following clause:
- 1) This policy shall not be canceled or reduced in required limits of liability or amounts of insurance until notice has been mailed to the County stating date of cancellation, reduction or other adverse change respecting such insurance. The date of cancellation, reduction or adverse change may not be less than thirty (30) calendar days after date of mailing notice."
- c. Any notice required to be sent pursuant to this Article shall be to the County's address as shown in the Advertisement for Bids.
- d. Certificates of insurance shall state in particular those insured, extent of insurance, location and operation to which insurance applies, expiration date, and cancellation and reduction notice. All Certificates of Insurance provided by Contractor shall name the County, the Construction Manager and Architect, and Construction Manager's and Architect's consultants as additional insured.
- e. The coverage afforded by the additional insured endorsement described in paragraph (d) above, shall apply as primary insurance, and any other insurance maintained by the County owner, the members of the County's Board of Supervisors, or its officers, agents, employees and volunteers, or any self-funded program of the County, shall be in excess only and not contributing with such coverage. This coverage must be given via ISO endorsement CG 2010 (11/85 ed.) or insurer's equivalent for coverage as respects: liability arising out of activities performed by or on behalf of the Contractors; products and completed operations of the Contractor; premises owned, occupied or used by the Contractor; or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the County, its board of trustees, directors, officers, employees, agents or authorized volunteers.
- f. Insurance carriers shall be qualified to do business in California and maintain an agent for service of process within the State. Such insurance carriers shall have not less than an "A" policy holder's rating and a financial rating of not less than "Class VII" according to the latest Best's Key Rating Guide unless otherwise approved by the County.
- g. After receiving written Notice of Cancellation of Insurance, Contractor shall have ten (10) calendar days to provide other policies of insurance similar to the canceled policies and acceptable insurance. If such replacement coverage is not provided, the County may secure insurance at the Contractor's expense.
- h. Nothing contained in the insurance requirements shall be construed as limiting the extent of the Contractor's responsibility for payment of damages resulting from operations under this Contract.
- i. Contractor's failure to procure the insurance specified herein, or failure to deliver certified copies or appropriate certificates of such insurance, or failure to make the premium payments required by such insurance, shall constitute a material breach of the Contract, and the County may, at its option, terminate the Contract for any such default by Contractor.
- j. The requirements as to the types and limits of insurance coverage set forth herein and in the Supplementary Conditions to be maintained by the Contractor, and any approval of said insurance by the County or its insurance Contractor(s), are not intended to and shall not in any manner limit or qualify the liabilities and obligations otherwise assumed by the Contractor pursuant to the Contract, including, but not limited to, the provisions concerning indemnification.
- k. The County shall retain the right at any time to review the coverage, form, and amount of insurance required herein and may require Contractor to obtain insurance reasonably sufficient in coverage, form and amount to provide adequate protection against the kind and extent of risk which exists at the time a change in insurance is required.
- l. All deviations from the contractual insurance requirements stated herein must be approved in writing by the County's risk manager.
- m. Included in any policy or policies of liability insurance provided by Contractor hereunder, except Workers' Compensation Insurance, shall be a standard waiver of rights of subrogation against the County, its Representatives, or Agents, by the insurance company issuing said policy or policies.
- n. If coverage is written on a "claims made" basis, the Certificate of Insurance shall clearly so state. In addition to the coverage requirements specified above, such policy shall provide that:
- 1) The policy retroactive date coincides with or precedes Contractor's commencement of work under the Contract (including subsequent policies purchased as renewals or replacements)
 - 2) Contractor will make every effort to maintain similar insurance during the required extended period of coverage following expiration of the Contract, including the requirement of adding all additional insureds. If insurance is terminated for any reason, Contractor shall purchase an extended reporting provision of at least two years to report claims arising in connection with the Contract.

- p. Contractor shall notify the County in writing of the amount, if any, of self-insured retention provided under the General Liability coverage, with a maximum limit of \$25,000. The County may approve higher retention amounts, based upon review of documentation submitted by Contractor. Such review shall take into consideration Contractor's net worth and reserves for payment of claims of liability against Contractor, which must be sufficient to adequately compensate for the lack of other insurance coverage required hereunder.

ARTICLE 31. INDEMNIFICATION

The County and its Board members, directors, officers, employees, agents and authorized volunteers, County's Representative, the Construction Manager, and the Architect, shall not be answerable or accountable in any manner for any loss or damage that may happen to the work or any part thereof, or for any of the materials or other things used or employed in performing the Work, of for injury or damage to any person or persons, either workers, employees of Contractor or its subcontractors or the public, or for damage to adjoining or other property, from any cause whatsoever arising out of or in connection with the performance of the Work. The Contractor shall be responsible for any damage to adjoining or other property, from any cause whatsoever arising out of or in connection with the performance of the work. The Contractor shall be responsible for any damage or injury to any person or property resulting from defects or obstructions or from any cause whatsoever arising out of or in connection with the performance of the Work; provided, however, that the Contractor shall not be liable for the sole established negligence, willful misconduct or active negligence of the County, its Board members, directors, officers, employees, agents and authorized volunteers who are directly responsible to the County.

- a. Contractor shall indemnify the County and its Board members, directors, officers, employees, agents, authorized volunteers, the County's Representatives, the Construction Manager and the Architect against and will hold and save them and each of them harmless from any and all actions, claims, damages to persons or property, penalties, obligations or liabilities that may be asserted or claimed by any person, firm entity, corporation, political subdivision or other organization arising out of or in connection with the Work, operation or activities of Contractor, its agents, employees, subcontractors or invitees, provided for herein, whether or not there is concurrent passive or active negligence on the part of the County, or its Board members, directors, officers, employees, agents, and authorized volunteers, the County's Representative, the Construction Manager, and the Architect, but excluding such actions, claims, damages to persons or property penalties, obligations or liabilities arising from the sole established negligence, willful misconduct or active negligence of the County, the County's Representative, the Construction Manager, the Architect, or those who are directly responsible to them, and in connection therewith:
- 1) Contractor will defend any action or actions filed in connection with any of said claims, damages, penalties, obligations or liabilities and will pay all costs and expenses, including attorney's fees incurred in connection therewith.
 - 2) Contractor will promptly pay any judgment rendered against Contractor, the County and its Board members, directors, officers, employees, agents, authorized volunteers, the County's Representative, the Construction Manager, and the Architect, covering such claims, damages, penalties, obligations and liabilities arising out of or in connection with such work, operations, or activities of Contractor hereunder and Contractor agrees to save and hold the County and its members, directors, officers, employees, agents, authorized volunteers, the County's Representative, the Construction Manager, and the Architect harmless therefrom.
 - 3) In the event the County and its Board members, directors, officers, employees, agents, authorized volunteers, the County's Representative, the Construction Manager, and the Architect are made a party to any action or proceeding filed or prosecuted against Contractor for such damages or other claims arising out of or in connection with the Work, or operation or activities of Contractor hereunder, Contractor agrees to pay to the County, the County's Representative, the Construction Manager and the Architect, and its Board members, directors, officers, employees, agents, authorized volunteers, the County's Representative, the Construction Manager, and the Architect any and all costs and expenses incurred by the County and its Board members, directors, officers, employees, agents and authorized volunteers, the County's Representative, the Construction Manager and the Architect, in such action or proceeding together with reasonable attorney's fees.
 - 4) The County may retain, to the extent it deems necessary, the money due to the Contractor under and by virtue of the Contract Documents until disposition has been made of such actions or claims for damages as specified herein above.

ARTICLE 32. PERSONAL LIABILITY

Neither the County, the County's Representative, the Engineer, Construction Manager, Architect, nor any other director, officer or authorized assistant or agent of the County, the County's Representative, or the Engineer, Construction Manager, or Architect shall be personally responsible for any liability arising under the Contract.

ARTICLE 33. LAWS AND REGULATIONS

- a. Contractor shall give all notices and comply with all laws, ordinances, rules, and regulations bearing on conduct of work as indicated and specified. If Contractor observes that drawings and specifications are at variance therewith, he shall promptly notify the Construction Manager in writing and any necessary changes shall be adjusted as provided for in this Contract for changes in work. If Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Construction Manager, he shall bear all costs arising therefrom.
- b. Contractor shall be responsible for familiarity with the Americans with Disabilities Act ("ADA") (42 USC §12101 et seq.). Installations of equipment and other devices shall be in compliance with ADA regulations.

ARTICLE 34. PERMITS AND LICENSES

Building permit, and other required permits and licenses necessary for prosecution of work shall be secured and paid for by Contractor, unless otherwise specified.

ARTICLE 35. INSPECTION FEES FOR PERMANENT UTILITIES

All inspection fees and other municipal charges for permanent utilities including, but not limited to, sewer, electrical, phone, gas, water, and irrigation shall be paid for by the County. Contractor shall be responsible for arranging the payment of such fees, but inspection fees and other municipal fees relating to permanent utilities shall be paid by the County. Contractor may either request reimbursement from the County for such fees or obtain the funds from the County prior to paying such fees.

ARTICLE 36. EASEMENTS

Easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the County, unless otherwise specified.

ARTICLE 37. SURVEYS

Surveys to determine location of property lines and corners will be supplied by the County. Surveys to determine locations of construction, grading, and site work shall be provided by Contractor.

ARTICLE 38. EXCISE TAXES

If under federal excise tax law any transaction hereunder constitutes a sale on which a federal excise tax is imposed and the sale is exempt from such excise tax because it is a sale to a state or local government for its exclusive use, the County, upon request, will execute a certificate of exemption which will certify (1) that the County is a political subdivision of the state for the purposes of such exemption and (2) that the sale is for the exclusive use of the County. No excise tax for such materials shall be included in any bid price.

ARTICLE 39. PATENTS, ROYALTIES, AND INDEMNITIES

The Contractor shall indemnify, defend and hold harmless the County and its Board Members, officers, agents, and employees harmless from liability of any nature or kind, including cost and expense, for or on account of any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of this Contract, including its use by the County, unless otherwise specifically stipulated in the Contract Documents.

ARTICLE 40. MATERIALS

- a. Except as otherwise specifically stated in this Contract, Contractor shall provide and pay for all materials, labor, tools, equipment, water, lights, power, transportation, superintendence, temporary constructions of every nature, and all other services and facilities of every nature whatsoever necessary to execute and complete this Contract within specified time.
- b. Unless otherwise specified, all materials shall be new and the best of their respective kinds and grades as noted and/or specified, and workmanship shall be of good quality.
- c. Materials shall be furnished in ample quantities and at such times as to insure uninterrupted progress of work and shall be stored properly and protected as required. Contractor shall be entirely responsible for damage or loss by weather or other causes to materials or work under this Contract.
- d. No materials, supplies, or equipment for work under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale or other agreement by which an interest therein or in any part thereof is retained by seller or supplier. Contractor warrants good title to all material, supplies, and equipment installed or incorporated in work and agrees upon completion of all work to deliver premises, together with all improvements and appurtenances constructed or placed thereon by him, to the County free from any claims, liens, or charges. He further agrees that neither he nor any person, firm, or corporation furnishing any materials or labor for any work covered by this Contract shall have any right to lien upon premises or any improvement or appurtenance thereon, except that Contractor may install metering devices or other equipment of utility companies or of political subdivisions title to which is commonly retained by utility

company or political subdivision. In event of installation of any such metering device or equipment, Contractor shall advise the County as to the owner thereof. Nothing contained in this Article, however, shall defeat or impair right of persons furnishing material or labor under any bond given by Contractor for their protection or any rights under any law permitting such persons to look to funds due Contractor in hands of the County, and this provision shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing material for work when no formal contract is entered into for such material.

- e. Materials shall be stored on the premises in such manner so as not to interfere with the work and so that no portion of the structure shall be overloaded.
- f. Materials or work required or necessary to be tested shall be tested under supervision of, as directed by and at such places as may be convenient to the County and/or the County's Representatives. The required testing of all structural materials shall be done by an approved testing laboratory as pursuant to Article 70, herein.

ARTICLE 41. SUBSTITUTIONS

- a. For purposes of this provision the term "substitution" shall mean the substitution of any material, process or article that is substantially equal or better in every respect to that so indicated or specified in the specifications.
- b. Pursuant to Public Contract Code Section 3400(b) the County may make a finding that is described in the invitation for bids that designates certain products, things, or services by specific brand or trade name for the statutorily enumerated purposes. As required by Section 3400 (b) the County has made such findings as further described in the Supplementary Conditions.
- c. Unless specifically designated in the Supplementary Conditions, whenever in specifications any material, process, or article is indicated or specified by grade, patent, or proprietary name or by name of manufacturer, such specifications shall be deemed to be used for the purpose of facilitating the description of the material, process or article desired and shall be deemed to be followed by words "or equal." Contractor may, unless otherwise stated, offer for substitution any material, process or article which shall be substantially equal or better in every respect to that so indicated or specified. However, the County has adopted certain uniform standards for certain materials, processes and articles. If any material, process or article offered for substitution is not, in the opinion of the Architect and the County, substantially equal or better in every respect to that specified, Contractor shall furnish the material, process or article specified. The burden of proof as to the equality of any material, process or article shall rest with the Contractor.
- d. Contractor shall submit requests together with substantiating data for substitution of any "or equal" material, process or article no later than 5 days prior to bid opening. Provisions authorizing submission of "or equal" substitution justification data shall not in any way authorize an extension of time for performance of this Contract. Furthermore, if a proposed "or equal" substitution request is rejected, Contractor shall be responsible for including the specified material, process or article in its bid. The County shall not be responsible for any costs associated with "or equal" substitution requests. The County has the complete and sole discretion to determine if a material, process or article is an "or equal" material, process or article that may be substituted.
- e. For purposes of subdivision (d) above, data required to substantiate requests for substitutions of an "or equal" material, process or article shall include a signed affidavit from the Contractor stating that the substituted "or equal" material, process or article is equivalent to that specified in the specification in every way except as listed on the affidavit. Substantiating data shall also include any and all illustrations, specifications, and other relevant data including catalogue information which describes the requested substituted "or equal" material, process or article and substantiates that it is an "or equal" to the material process or article specified. In addition, the submittal documentation must also include a statement of the cost implications of the substitution being requested stating whether and why the substitution of the "or equal" material, process or article will reduce or increase the Contract Price. The substantiating data must also include information regarding the durability and lifecycle cost of the requested substituted "or equal" material, process or article. Failure to submit all the needed substantiating data, including the signed affidavit, to the Construction Manager in a timely fashion so that the substitution can be adequately reviewed may result in the rejection of the proposed substitution. The Construction Manager and Architect are not obligated to review multiple substitution submittals for the same product or item due to the Contractor's failure to submit a complete package initially.
- f. Time limitations in this Article must be complied with strictly and in no case will an extension of time for completion be granted because of Contractor's failure to request the substitution of an alternative item at the times and manner set forth herein in subdivision (d). Further, the Contractor shall bear the costs of all engineering work associated with the review of submittals for substitution of equals.
- g. In event Contractor furnishes material, process, or article more expensive than that specified, the difference in cost of such material, process, or article so furnished shall be borne by Contractor.

ARTICLE 42. SHOP DRAWINGS

- a. Contractor shall check and verify all field measurements and shall submit with such promptness as to cause no delay in his own work or in that of any other contractor, subcontractor, Construction Manager, Architect, other independent contractor or worker on the Project, five (5) copies of all shop or setting drawings, schedules, and materials list, and all other submittals in accordance with other provisions of the Contract required for the work of various trades. Contractor shall sign all submittals affirming that submittals have been reviewed and approved by Contractor prior to submission to Construction Manager. Each signed submittal shall affirm that the submittal meets all the requirements of the Contract Documents except as specifically and clearly noted and listed on the cover sheet of the submittal.
- b. Contractor shall advise the County immediately, if Construction Manager and/or Architect have not checked and approved with reasonable promptness, such schedules and drawings for conformance with design concept of Project and compliance with information given in the Contract Documents. Contractor shall make any corrections required by the Architect, and file with the Construction Manager five (5) corrected copies each and furnish such other copies as may be needed for construction. Architect's approval of such drawings or schedules also shall not relieve Contractor from responsibility for deviations from drawings or specifications unless Contractor has in writing called Construction Manager's attention to such deviations at time of submission and has secured the Architect's written approval. Architect's approval of such drawings and schedules also shall not, nor shall it relieve him from responsibility for errors in shop drawings or schedules. For purposes of this Article "reasonable promptness" shall mean such reasonable promptness as to cause no delay in the work or in the activities of the County, Contractor, or separate contractors, while allowing sufficient time in the Construction Manager and Architect's professional judgment to permit adequate review. In contracts in excess of \$1 million, "reasonable promptness" shall mean such reasonable promptness as to not affect the critical path.

ARTICLE 43. SUBMITTALS

- a. Contractor shall furnish for approval, within fourteen (14) calendar days following award of Contract a log of all samples, material lists and certifications, mix designs, schedules, and other submittals, as required in specifications. Such log shall indicate whether samples will be provided as specified and in accordance with other provisions of this Contract.
- b. Contractor will provide samples and submittals, together with catalogs and supporting data required by the Architect to the Construction Manager within a reasonable time period so as not to cause delays on the Project.
- c. This provision shall not authorize any extension of time for performance of this Contract. Architect will check and approve such samples, only for conformance with design concept of work and for compliance with information given in the Contract Documents. Work shall be in accordance with approved samples. Architect's action will be taken within fourteen (14) calendar days after receiving such samples and submittals. If in the Construction Manager's and/or Architect's professional judgment fourteen (14) calendar days is an insufficient amount of time to permit adequate review, Construction Manager shall, within the initial fourteen (14) calendar days period, notify the Contractor, with a copy to the Inspector and the County, of the amount of time that will be required to respond.
- d. If the Architect's response results in a change in the Project, then such change shall be effected by a written change order.

ARTICLE 44. COST BREAKDOWN AND PERIODICAL ESTIMATES

- a. Contractor shall furnish on forms approved by the County:
 - 1) Within ten (10) calendar days of award of Contract a detailed estimate giving a complete breakdown of Contract Price; and
 - 2) A periodical itemized estimate of work done for the purpose of making partial payments thereon;
 - 3) Within ten (10) calendar days of request by the County, a schedule of estimated monthly payments which shall be due him under the Contract.
- b. Values employed in making up any of these schedules will be used only for determining basis of partial payments and will not be considered as fixing a basis for additions to or deductions from Contract Price.

ARTICLE 45. PAYMENTS

- a. Each month within thirty (30) calendar days after receipt of an undisputed and properly submitted payment request, there shall be paid to Contractor a sum equal to ninety five percent (95%) of the value of work performed up to the last day of the previous month, less the aggregate of previous payments. Monthly payments shall be made only on the basis of monthly estimates which shall be prepared by Contractor on a form approved by the County and filed with the County before the fifth day of the month during which payment

is to be made. Work completed as estimated shall be an estimate only and no inaccuracy or error in said estimate shall operate to release Contractor or any bondsman from damages arising from such work or from enforcing each and every provision of this Contract and the County shall have the right subsequently to correct any error made in any estimate for payment. Contractor shall not be entitled to have any payment estimates processed or be entitled to have any payment made for work performed so long as any lawful or proper direction concerning work, or any portion thereof given by the County, Construction Manager and/or Architect shall remain uncomplied with.

- b. The final payment of five percent (5%) of the value of work done under this Contract, if unencumbered, shall be made within sixty (60) calendar days after the date of completion of the work, provided however, that in the event of a dispute between the County and the Contractor, the County may withhold from the final payment an amount not to exceed one hundred and fifty percent (150%) of the disputed amount. Completion means any of the following as provided by Public Contract Code Section 7107:
 - 1) The occupation, beneficial use, and enjoyment of a work of improvement, excluding any operation only for testing, startup, or commissioning, by the public agency, or its agent, accompanied by cessation of labor on the work of improvement.
 - 2) The acceptance by the public agency, or its agent, or the work of improvement.
 - 3) After the commencement of a work of improvement, a cessation of labor on the work of improvement for a continuous period of 100 calendar days or more, due to factors beyond the control of the Contractor.
 - 4) After the commencement of a work of improvement, a cessation of labor on the work of improvement for a continuous period of 30 calendar days or more, if the public agency files for record a notice of cessation or a notice of completion
- c. This Contract is subject to the provisions of Public Contract Code Section 7107.
- d. For purposes of this Contract, the acceptance by the County means acceptance made only by an action of the governing body of the County in session. Acceptance by Contractor of said final payment shall constitute a waiver of all claims against the County arising from this Contract. At any time after fifty percent (50%) of the work has been completed, if the County, by action of its governing body, finds that satisfactory progress is being made, the County may make any of the remaining payments in full for actual work completed or may withhold any amount up to five percent (5%) thereof as the County may find appropriate based on the Contractor's progress.
- e. Final Payment. The County shall, after the satisfactory completion of the work, make a final estimate of the amount of Work done thereunder and the value of said work, and the County shall pay the entire sum so found to be due after deduction therefrom all previous payments and all amounts to be retained under the provisions of the Contract Documents, provided that a release of liens and claims has been received from the Contractor pursuant to Civil Code Section 3262. All prior partial estimates and payments shall be subject to correction in the final estimate and payment. The final payment shall not be due and payable until the expiration of thirty-five (35) calendar days from the date of acceptance of the work by the County, which acceptance shall be by formal action of the Board of Supervisors.
 - 1) No certificate given, or payments made under the Contract, except the final certificate or final payment shall be evidence of the performance of the Contract, either wholly or in part, and no payment shall be construed to be an acceptance of any defective work or improper materials.
- f. Whenever any part of the work is in a condition suitable for use, and the best interest of the County requires such use, the County may take possession of, connect to, open for public use, or use a part thereof. When so used, maintenance and repairs due to ordinary wear and tear or vandalism will be made at County's expense. The use by the County as contemplated in this Article shall in no case be construed as constituting acceptance of the work or any part thereof. Such use shall neither relieve the Contractor of any of his responsibilities under the Contract nor act as a waiver by the County of any of the conditions thereof. Contractor shall continue to maintain all insurance, including Builder's Risk insurance, on the Project.

ARTICLE 46. PAYMENTS WITHHELD

- a. In addition to amounts which the County may retain under any and all other Articles in this Contract including those entitled "Payments," and "Time for Completion and Liquidated Damages," the County may withhold a sufficient amount or amounts of any payment or payments otherwise due to Contractor, as in his judgment may be necessary to cover:
 - 1) Payments which may be past due and payable for just claims against Contractor or any subcontractors for labor or materials furnished in and about the performance of work on the Project under this Contract.
 - 2) Defective work not remedied.

- 3) Failure of Contractor to make proper payments to his subcontractor or for material or labor.
 - 4) Completion of the Contract if there exists a reasonable doubt that the work can be completed for balance then unpaid.
 - 5) Damage to another Contractor.
 - 6) Amounts which may be due the County for just claims against Contractor.
 - 7) Failure of Contractor to keep the record ("as-built") drawings up to date.
 - 8) Failure to provide update on construction schedule as required by Article 8 hereof. When the above grounds are removed, payment shall be made for amounts withheld because of them.
 - 9) Site cleanup.
- b. The County may apply such withheld amount or amounts to payment of such claims or obligations at its discretion with the exception of subsections (a)(1), (3), and (5) of this Article, which must be retained or applied in accordance with applicable law. In so doing, the County shall be deemed the agent of Contractor and any payment so made by the County shall be considered as a payment made under contract by the County to Contractor and the County shall not be liable to Contractor for such payments made in good faith. Such payments may be made without prior judicial determination of claim or obligations. The County will render Contractor a proper accounting of such funds disbursed on behalf of Contractor.

ARTICLE 47. CHANGES AND EXTRA WORK

- a. Changes In Work. The County, without invalidating the Contract, and as provided by law, may order extra work or make changes by altering, adding to, or deducting from work, the Contract sum being adjusted accordingly. All such work shall be subject to prevailing wage rates and shall be executed under the conditions of the original contract except that any claim for extension of time caused thereby shall be adjusted at the time of ordering such change.
- b. In giving instructions, Contractor agrees that the Construction Manager and Architect, together, shall have authority to make minor changes in work, not involving change in cost, and not inconsistent with the purposes or approvals of the Project. Otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless pursuant to a written order from the County, and no claim for an addition to the Contract sum shall be valid unless so ordered. If the Contractor is delayed in completing the work by reason of any change made pursuant to this Article, the time for completion of the Work shall be extended by change order for a period commensurate with such delay. The Contractor shall not be subject to any claim for liquidated damages for this period of time.
- c. Unforeseen Conditions. Contractor shall provide the County's Construction with notice of unforeseen conditions immediately upon discovery of such conditions.
- d. Value of any such extra work, change, or deduction shall be determined at the discretion of the County, in consultation with the Construction Manager and Architect, in one or more of the following ways:
 - 1) By acceptable lump sum proposal from Contractor with itemization as required by the Construction Manager.
 - 2) By unit prices contained in Contractor's original bid and incorporated in the Contract Documents or fixed by subsequent agreement between the County and Contractor.
 - 3) By the actual cost of material and labor and a percentage for overhead and profit. The following form shall be followed as applicable for additions and deductions to the Contract:

EXTRA/ (CREDIT)

(a) Material (attach itemized quantity and unit cost plus sales tax)	
(b) Labor (attach itemized hours and base rates from identified prevailing wage rate schedules)	
(c) Commercial General Liability and Property Damage Insurance, Workers' Compensation Insurance, Social Security and Unemployment taxes at actual and verified cost.	
(d) Subtotal	
(e) Subcontractor's overhead and profit as defined in Article 47 (h), below, not to exceed 15% of Item (d)	

(if applicable)	
(f) Subtotal	
(g) Contractor's Overhead and Profit, as defined in Article 47 (h), below, not to exceed 5% of Item (f) for work performed by subcontractor, or 15% if performed by Contractor \	
(h) Subtotal	
(i) Bond Premium, not to exceed 1% of Item (h)	
(j) Total	

- e. Regardless of whether the cost of the change order is determined pursuant to 1, 2, or 3, above, in addition to the cost of the material and labor for deleted items, Contractor shall credit back overhead mark-up and the bonding mark up for deleted items at the time of the request for changes and extra work.
- f. Should Contractor claim that any instruction, request, drawing, specification, action, condition, omission, default, or other situation (i) obligates the County to pay additional compensation to the Contractor; or (ii) obligates the County to grant an extension of time for the completion of the Contract; or (iii) constitutes a waiver of any provision in the Contract, CONTRACTOR SHALL NOTIFY THE COUNTY, IN WRITING, OF SUCH CLAIM AS SOON AS POSSIBLE, BUT IN NO EVENT WITHIN MORE THAN FIVE (5) WORKING DAYS FROM THE DATE CONTRACTOR HAS ACTUAL OR CONSTRUCTIVE NOTICE OF THE CLAIM. CONTRACTOR SHALL ALSO PROVIDE COUNTY WITH SUFFICIENT WRITTEN DOCUMENTATION SUPPORTING THE FACTUAL BASIS OF THE CLAIM including in the documentation items D (3) a-j described in this Article 47 above. Contractor shall be required to certify under penalty of perjury the validity and accuracy of any claims submitted. The Contractor's failure to notify the County within such five (5) working day period shall be deemed a waiver and relinquishment of the claim against the County. If such notice be given within the specified time, the procedure for its consideration shall be as stated above in this Article.
- g. All costs associated with the change are to be included in the change order proposal to the Construction Manager. Costs may be in terms of time, money or both.
- h. Overhead and Profit. The term "overhead and profit" for the Contractor and any subcontractors shall be considered to include: insurance, other than mentioned in Article 47(d) above, field and office supervisors and assistants, watchman, use of small tools, consumables, and general field and home office expenses, and no separate allowance will be made therefor.

ARTICLE 48. DEDUCTIONS FOR UNCORRECTED WORK

If the County in consultation with the Construction Manager and Architect deems it inexpedient to correct work injured or not done in accordance with the Contract, an equitable deduction from the Contract Price shall be made therefor.

ARTICLE 49. PAYMENTS BY CONTRACTOR

Contractor shall pay:

- a. For all transportation and utility services not later than the 20th day of the calendar month following that in which such services are rendered,
- b. For all materials, tools, and other expendable equipment to the extent of ninety five percent (95%) of cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools, and equipment are delivered at site of Project and balance of cost thereof not later than the 30th day following completion of that part of work in or on which such materials, tools, and equipment are incorporated or used, and
- c. To each of his subcontractors, not later than the 7th day following each payment to Contractor, the respective amounts allowed Contractor on account of work performed by respective subcontractor to the extent of such subcontractor's interest therein.

ARTICLE 50. CONTRACTOR'S SUPERVISION

- a. Unless personally present on the premises where work is being done, Contractor shall keep on the work, during its progress, a competent full-time job (project) superintendent satisfactory to the County's Construction Manager. The job superintendent shall not be changed except with consent of the County unless the job superintendent proves to be unsatisfactory to Contractor and ceases to be in his employ. The job superintendent shall represent Contractor in his absence and all directions given to him shall be as binding as if given to Contractor. Other directions shall be so confirmed on written request in each case.

- b. Contractor shall give efficient supervision to work, using his best skill and attention to control safety and job coordination. He shall carefully study and compare all drawings, specifications, and other instructions and shall at once report to the Construction Manager of any error, inconsistency, or omission which he may discover.

ARTICLE 51. COUNTY'S INSPECTOR

- a. One or more Inspectors employed by County in accordance with requirements of Title 19, 21 and/or 24 of the California Code of Regulations will be assigned to the work. His duties are specifically defined in the California Code of Regulations.
- b. Inspector shall have access to all plant operations involving work under this Contract and shall be provided reasonable advance notice of the time and place of operations which the Inspector desires to observe. Inspector shall be provided with all necessary samples of materials and work for testing purposes. All work shall be under the observation of said Inspector. He shall have free access to any or all parts of work at any time. Contractor shall furnish Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting progress and manner of work and character of materials. Inspection of work shall not relieve Contractor from any obligation to fulfill this Contract. Inspector, after consultation with the Construction Manager and Architect, together, shall have authority to stop work whenever the provisions of the Contract Documents are not being complied with and Contractor shall instruct his employees accordingly.

ARTICLE 52. INSPECTOR'S FIELD OFFICE

- a. Provide and maintain prefabricated or mobile unit or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Inspector field office shall be at least 200 sq.ft. with at least one window and one entrance door with steps and 1 (one) ramp, entry platform, and cylinder locks and four keys. Door locks shall include a deadbolt type. All windows shall be provided with security bars (no wire mesh or metal screen).
- b. General Requirements:
 - 1. Tile floor
 - 2. Operable screened windows and shades
 - 3. Adequate lighting – interior and exterior at door.
 - 4. Adequate electrical outlets
 - 5. Heating, ventilating and air conditioning equipment in operable condition.
 - 6. Bi-weekly deliveries of purified bottled water in adequate quantities.
 - 7. One (1) multifunction machine with the following capabilities: network color print, copying, scanning, faxing, auto feed, sort, group, staple enlarge and reduce documents, with copy size capability of 11"x17".
- c. Furniture and Equipment:
 - 1. One desk, minimum 32 x 66 inches
 - 2. One desk adjustable chair
 - 3. Plan table
 - 4. High speed internet access
- d. Temporary Toilet Unit: Provide self-contained, single-occupant toilet unit of the chemical aerated recirculation, or combustion type. Provide hand wash station. Provide unit properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Chemical toilets are to be cleaned twice per week.

ARTICLE 53. DOCUMENTS ON WORK

- a. Contractor shall keep one copy of all Contract Documents, including addenda, change orders, Division I, Title 21 of the California Code of Regulations (Building Standards Administrative Code), Title 24 of the California Code of Regulations, and the prevailing wage rates applicable at the time of the Contract, the Uniform Building Code and any other laws, rules or regulations governing building standards for public construction, which by this reference is a part of the Contract Documents, on job at all times. Said documents shall be kept in good order and available to both the Construction Manager and the Architect and their representatives. Contractor shall be acquainted with and comply with the provisions of said these laws, rules or regulations as they relate to this Project. Contractor shall also be acquainted with and comply with all California Code of Regulations provisions relating to this Project, particularly Titles 19, 21 and 24 of the California Code of Regulations.
- b. Contractor shall also make available all books, records, accounts, contracts, bids, etc. upon request of the County.

ARTICLE 54. RECORD ("AS BUILT") DRAWINGS

- a. Contractor shall maintain a clean, undamaged set of contract drawings and shop drawings. In addition to maintaining one complete set of record drawings (herein referred to as "asbuilts"), Contractor shall require each trade to do its own as-builts. The trade as-builts shall contain information showing clean and clear drawings with horizontal and vertical controls suitable for conversion to electronic media. Graphic quality must be equal to clean and clear original drawings. Adequacy of the drawings shall be determined by the County's representative or architect. Contractor shall mark the set to show the actual installation where the installation varies from the work as originally shown. Contractor shall mark whichever drawings are most capable of showing conditions fully and accurately where shop drawings are used, record a cross-reference at the corresponding location on the contract drawings. Contractor shall give particular attention to concealed elements that would be difficult to measure and record at a later date. Contractor shall use colors to distinguish variations in separate categories of the work.
- b. Contractor shall note related change order numbers where applicable. Contractor shall organize record drawings sheets into manageable sets, bound with durable paper cover sheets and shall print suitable title, dates and other identification on the cover of each set.
- c. At the end of the Project, the Contractor shall provide the County Representative with a complete set of as-built drawings. The complete set shall contain information showing clean and clear drawings with horizontal and vertical controls suitable for conversion to electronic media. Graphic quality must be equal to clean and clear original drawings; adequacy of the drawings shall be determined by the County's representative or architect. The as-builts must show the entire site for each major trade, including but not limited to water, sewer, electrical, data, telephone, cable, fire alarm, gas and plumbing.

ARTICLE 55. UTILITY USAGE

- a. All temporary utilities, including but not limited to electricity, water, gas, and telephone used on work shall be furnished and paid for by Contractor. Contractor shall furnish and install necessary temporary distribution systems, including meters, if necessary, from distribution points to points on site where utility is necessary to carry on the work. Upon completion of work, Contractor shall remove all temporary distribution systems.
- b. Contractor shall provide necessary and adequate utilities and pay all costs for water, electricity, gas, oil, and sewer charges required for completion of the Project.
- c. All permanent meters installed shall be listed in the Contractor's name until completion occurs, as defined in Article 7 hereof, at which time further pro-rating will be determined if necessary. When the County begins using the Project, charges over and above power actually used for construction will be the responsibility of the County.
- d. If the Contract is for construction in existing facilities, Contractor may, with written permission of the County, use the County's existing utilities by making prearranged payments to the County for utilities used by Contractor for construction.

ARTICLE 56. SANITARY FACILITIES

Contractor shall provide sanitary temporary toilet buildings for the use of all workers, as directed by the Construction Manager. All toilets shall comply with local codes and ordinances. Toilets shall be kept supplied with toilet paper and shall have workable door fasteners. Toilets shall be serviced no less than once weekly and shall be present in a quantity of not less than 1 per 20 workers as required by CAL-OSHA regulation. The building shall be maintained in a sanitary condition at all times and shall be left at the site until the Inspector directs removal. Use of toilet facilities in the work under construction shall not be permitted except by approval of the Construction Manager.

ARTICLE 57. TRENCHES

- a. Trenches Five Feet or More in Depth. The Contractor shall submit to the County's Construction, for acceptance, in advance of excavation, a detailed plan showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground during the excavation of any trench or trenches five feet or more in depth. The plan shall be prepared by a registered civil or structural engineer. As part of the plan, a note shall be included stating that the registered civil or structural engineer certifies that the plan complies with CAL-OSHA Construction Safety Orders or stating that the registered civil or structural engineer certifies that the plan is not less effective than the shoring, bracing, sloping, or other provisions of the Safety Orders.
 - 1) All shoring submittals shall include surcharge loads from adjacent embankments, construction loads and spoil bank. Submittal shall indicate minimum horizontal distance from top of trench to edge of all surcharge loads for all cases of shoring and side slopes.
 - 2) Nothing in this Article shall relieve Contractor of the full responsibility for providing shoring, bracing sloping, or other provisions adequate for worker protection. If such plan varies from the shoring system standards established by the Construction Safety Orders, the plan shall be prepared by a registered

civil or structural engineer. No excavation of such trench or trenches shall be commenced until said plan has been accepted by the County or the person to whom authority to accept has been delegated by the County.

- b. Excavations Deeper than Four Feet. If work under this Contract involves digging trenches or other excavation that extends deeper than four feet below the surface, Contractor shall promptly, and before the following conditions are disturbed, notify the County's Construction Manager, in writing, of any:
- 1) Material that the Contractor believes may be material that is hazardous waste, as defined in Section 25117 of the Health and Safety Code that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.
 - 2) Subsurface or latent physical conditions at the site differing from those indicated.
 - 3) Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract. County or County's Representatives shall promptly investigate the conditions, and if it finds that the conditions do so materially differ, or do involve hazardous waste, and cause a decrease or increase in Contractor's cost of, or the time required for, performance of any part of the work, shall issue a change order under the procedures described in the Contract. In the event that a dispute arises between the County or County's Representative and the Contractor as to whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the work, the Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all work to be performed under the Contract. Contractor shall retain any and all rights provided either by contract or by law which pertain to the resolution of disputes and protests between the parties.

ARTICLE 58. REGIONAL NOTIFICATION CENTER - EXCAVATIONS

- a. Contractor, except in an emergency, shall contact the appropriate regional notification center at least two working days prior to commencing any excavation if the excavation will be conducted in an area or in a private easement which is known, or reasonably should be known, to contain subsurface installations other than the underground facilities owned or operated by the County, and obtain an inquiry identification number from that notification center. No excavation shall be commenced and carried out by the Contractor unless such an inquiry identification number has been assigned to the Contractor or any subcontractor of the Contractor and the County or the County's Representatives has been given the identification number by the Contractor.
- b. Emergency shall be defined as a sudden, unexpected occurrence, involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property, or essential public services. Emergency includes such occurrences as fire, flood, earthquake, or other soil or geologic movements, as well as such occurrences as riot, accident, or sabotage (Government Code Section 4216).
- c. Subsurface installation means any underground pipeline, conduit, duct, wire, or other structure operated or maintained in or across a public street or public right of way (Government Code Section 4216).

ARTICLE 59. PROTECTION OF WORK AND PROPERTY

- a. The Contractor shall be responsible for all damages to persons or property that occurs as a result of his fault or negligence in connection with the prosecution of this Contract. Contractor shall be responsible for the proper care and protection of all materials delivered and work performed until completion and final acceptance by the County. All work shall be solely at the Contractor's risk. Contractor shall adequately protect adjacent property from settlement or loss of lateral support as provided by law and the Contract Documents. Contractor shall take all necessary precautions for the safety of employees on the Project and shall comply with all applicable safety laws and building codes to prevent accidents or injury to persons on, about, or adjacent to premises where work is being performed. Contractor shall erect and properly maintain at all times, as required by conditions and progress of work, all necessary safeguards, signs, barriers, lights, and watchmen for protection of workers and the public and shall post danger signs warning against hazards created by such features in the course of construction. Contractor shall designate a responsible member of his organization on the work, whose duty shall be prevention of accidents. The name and position of the person so designated shall be reported to the County's Construction Manager by Contractor.
- b. In an emergency affecting safety of life or of work or of adjoining property, Contractor, without special instruction or authorization from either the Construction Manager, or the County, is hereby permitted to act, at his discretion, to prevent such threatened loss or injury, and he shall so act, without appeal, if so authorized or instructed by the Construction Manager or the County. Any compensation claimed by Contractor on account of emergency work shall be determined by agreement.
- c. Contractor shall provide such heat, covering, and enclosures as are necessary to protect all work, materials, equipment, appliances, and tools against damage by weather conditions.

- d. Contractor shall take adequate precautions to protect existing sidewalks, curbs, pavements, utilities, adjoining property, and structures, and to avoid damage thereto, and repair any damage thereto caused by construction operations. Contractor shall:
- 1) Enclose working area with a substantial barricade, arrange work to cause minimum amount of inconvenience and danger to the public.
 - 2) Provide substantial barricades around any shrubs or trees indicated to be preserved.
 - 3) Deliver materials to the building area over a route designated by both the Construction Manager and the Architect.
 - 4) When directed by the County, take preventive measures to eliminate objectionable dust and follow applicable Air Quality Management District air quality regulations as appropriate.
 - 5) Confine Contractor's apparatus, the storage of materials, and the operations of his workers to limits indicated by law, ordinances, permits, or directions of the Construction Manager. Contractor shall not unreasonably encumber premises with his materials. Contractor shall enforce all instructions of the County's Construction Manager regarding signs, advertising, fires, danger signals, barricades, and smoking and require that all persons employed on work comply with all regulations while on construction site.
 - 6) Take care to prevent disturbing or covering any survey markers, monuments, or other devices marking property boundaries or corners. If such markers are disturbed by accident, they shall be replaced by an approved civil engineer or land surveyor, licensed in the State of California, at no cost to the County.

ARTICLE 60. LAYOUT AND FIELD ENGINEERING

All field engineering required for laying out this work and establishing grades for earthwork operations shall be furnished by the Contractor at his expense. Such work shall be done by a qualified civil engineer approved by the Architect. Any required "as-built" drawings of site development shall be prepared by the approved civil engineer.

ARTICLE 61. REMOVAL OF HAZARDOUS MATERIALS

- a. Since removal and/or abatement of Asbestos, PCBs and other toxic wastes and hazardous materials is a specialized field of work with specialized insurance requirements, unless otherwise specified in the Contract Documents, the County shall contract directly for such specialized services, if required, and shall not require the Contractor to subcontract for such services.
- b. In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) which has not been rendered harmless, the Contractor shall immediately stop work in the area affected and report the condition to the County's Inspector, and the Construction Manager in writing. The work in the affected area shall not thereafter be resumed except by written agreement of the County and Contractor if in fact the material is asbestos or PCB and has not been rendered harmless. The work in the affected area shall be resumed in the absence of asbestos or PCB, or when it has been rendered harmless, by written agreement of the County and Contractor, or by arbitration under Article hereof.

ARTICLE 62. CUTTING AND PATCHING

- a. Contractor shall do all cutting, fitting, or patching of work as required to make its several parts come together properly and fit it to receive or be received by work of other contractors showing upon, or reasonably implied by, the drawings and specifications for the completed structure. Contractor shall make good after them as the Construction may direct.
- b. All cost caused by defective or ill-timed work shall be borne by party responsible therefor.
- c. Contractor shall not endanger any work by cutting, excavating, or otherwise altering work and shall not cut or alter work of any other contractor save with written consent of the Architect.

ARTICLE 63. CLEANING UP

- a. Contractor at all times shall keep premises free from debris such as waste, rubbish, and excess materials and equipment caused by this work. Contractor shall not leave debris under, in, or about the premises. Upon completion of work, Contractor shall clean the interior and exterior of the building or improvement including fixtures, equipment, walls, floors, ceilings, roofs, windowsills and ledges, horizontal projections, and any areas where debris has collected so surfaces are free from foreign material or discoloration. Contractor shall clean and polish all glass, plumbing fixtures, and finish hardware and similar finish surfaces and equipment and Contractor shall also remove temporary fencing, barricades, planking and construction toilet and similar temporary facilities from site. Contractor shall also clean all buildings, asphalt, and concrete areas to the degree necessary to remove oil, grease, fuel, or other stains caused by Contractor operations or equipment.

- b. If the Contractor fails to clean up at the completion of the Work, the County may do so and the cost of such clean up shall be charged back to the Contractor.

ARTICLE 64. CORRECTION OF WORK BEFORE FINAL PAYMENT

- a. Contractor shall promptly remove from the premises all work condemned by the County as failing to conform to the Contract, whether incorporated or not. Contractor shall promptly replace and re-execute his own work to comply with the Contract Documents without additional expense to the County and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.
- b. If Contractor does not remove such condemned work within a reasonable time, fixed by written notice, the County may remove it and may store the material at Contractor's expense. If Contractor does not pay expenses of such removal within ten (10) calendar days' time thereafter, the County may, upon ten (10) calendar days' written notice, sell such materials at auction or at private sale and shall account for net proceeds thereof, after deducting all costs and expenses that should have been borne by Contractor.

ARTICLE 65. ACCESS TO WORK

The County and its Representatives shall at all times have access to work wherever it is in preparation or progress. Contractor shall provide safe and proper facilities for such access so that The County's Representatives may perform their functions under contract.

ARTICLE 66. OCCUPANCY

The County reserves the right to occupy the building at any time before completion, and such occupancy shall not constitute final acceptance of any part of work covered by this Contract.

ARTICLE 67. TESTS AND INSPECTIONS

- a. If the Contract, the County's construction manager's, architects, instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, Contractor shall give notice in accordance with such authority of its readiness for observation or inspection at least two (2) working days prior to being tested or covered up. If inspection is by a public authority other than the County, Contractor shall inform the County's Construction Manager of date fixed for such inspection. Required certificates of inspection shall be secured by Contractor. Observations by the County, Construction Manager, Architect, or Inspector shall be promptly made and where practicable at source of supply. If any work should be covered up without approval or consent of the County, Construction Manager and/or Architect, it must, if required by the County's Construction Manager, be uncovered for examination and satisfactorily reconstructed at Contractor's expense in compliance with the Contract. Costs of tests of any materials found not to be in compliance with the Contract shall be paid by the Contractor.
- b. Where such inspection and testing are to be conducted by an independent laboratory or agency, such materials or samples of materials to be tested shall be selected by such laboratory or agency, or the County's representative, and not by Contractor. All test or inspections of materials shall be made in accordance with the commonly recognized standards of national organizations.
- c. In advance of manufacture of materials to be supplied by Contractor under the Contract, which by the terms of the Contract must be tested, Contractor shall notify the County's Construction Manager in advance so that the County and its Representatives may arrange for testing of same at the source of supply. Any materials shipped by Contractor from the source of supply prior to having satisfactorily passed such testing and inspection, or prior to receipt of notice from the County's Representative that such testing and inspection will not be required, shall not be incorporated into the work without the prior approval of the County or its Representatives and subsequent testing and inspection.
- d. Reexamination of questioned work may be ordered by the County or its Representatives. If so ordered, work must be uncovered by Contractor. If such work is found to be in accordance with the Contract Documents, the County shall pay the costs of reexamination and replacement. If such work be found not to be in accordance with the Contract Documents, Contractor shall pay such costs.

ARTICLE 68. SOILS INVESTIGATIONS

When a soils investigation report obtained from test holes at the site is available, such report shall not be a part of this Contract. Any information obtained from such report or any information given on drawings as to subsurface soil condition or to elevations of existing grades or elevations of underlying rock is approximate only, is not guaranteed, and does not form a part of the Contract. Contractor is required to make a visual examination of site and must make whatever tests he deems appropriate to determine the underground condition of the soil. Contractor agrees that he will make no claim against the County for damages in the event that during the progress of the work Contractor encounters subsurface or latent conditions at the site materially differing from those shown on drawings or indicated in specifications, or for unknown conditions of an unusual nature which differ materially from those ordinarily encountered and generally recognized as inherent in the work of the character provided for in plans and specifications.

ARTICLE 69. CONSTRUCTION MANAGER'S AND ARCHITECT'S STATUS

- a. Both the Architect and the Construction Manager shall be the County's representatives during the construction period, and shall have the responsibilities and authorities to act on behalf of the County only to the extent identified in the Contract Documents, and generally as follows:
 - 1) The Architect is responsible for: Interpreting the approved plans and specifications and providing any necessary amplification of the plans and specifications. Observing the construction and, in the first instance, judging the Contractor's performance with respect to the quality standards for materials and work in place. Accepting and approving decisions and clarifications, pertaining to the technical aspects of the Contract Documents.
 - 2) The Construction Manager is responsible for: Serving as the Contractor's point of contact for management and administration of the Contract and coordination of interfaces with other Contractors and organizations participating in the same or adjacent projects, as well as those of the Architect and Inspector. Implementing the established procedures for processing all required submissions and documentation. Monitoring and reviewing the Contractor's safety program, personnel and equipment, scheduling and progress of the work, and, without assuming any of the Architect's legal responsibilities, the work of the Contractor for conformance with the Contract Documents.
- b. The Construction Manager shall have authority to direct stoppage of the work whenever such stoppage may be necessary in the Construction Manager's, the Architect's, or Inspector's reasonable opinion to insure the proper execution of the Contract.
- c. The County retains the authority to issue the ultimate decision in the event the Construction Manager and Architect cannot reach a consensus regarding any decisions, clarifications, instructions, directions, acceptances, or approvals required, issues, or made pursuant to the Contract Documents and in connection with the prosecution and progress of the Work.

ARTICLE 70. DECISIONS OF CONSTRUCTION MANAGER AND ARCHITECT

Contractor shall promptly notify the County in writing if either the Construction Manager or Architect fail within a reasonable time, make decisions on all claims of the County or Contractor and on all other matters relating to the execution and progress of the work.

ARTICLE 71. PROVISIONS REQUIRED BY LAW DEEMED INSERTED

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

ARTICLE 72. LABOR/EMPLOYMENT SAFETY

The Contractor shall maintain emergency first aid treatment for his employees which complies with the Federal Occupational Safety and Health Act of 1970 (29 USC, Section 651 et seq.), and California Code of Regulations, Title 8, Industrial Relations Division 1, Department of Industrial Relations, Chapter 4.

ARTICLE 73. ASSIGNMENT OF ANTITRUST ACTIONS

Pursuant to Section 7103.5 of the Public Contract Code, in entering into a public works contract or subcontract to supply goods, services, or materials pursuant to a public works contract, Contractor or subcontractor offers and agrees to assign to the County all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 USC, Section 15) or under the Cartwright Act (chapter 2 (commencing with Section 16700) of part 2 of division 7 of the Business and Professions Code), arising from the purchase of goods, services, or materials pursuant to this Contract or any subcontract. This assignment shall be made and become effective at the time the County tenders final payment to the Contractor, without further acknowledgment by the parties.

ARTICLE 74. NOTICE OF THIRD-PARTY CLAIMS

Pursuant to Public Contract Code Section 9201, the County shall provide Contractor with timely notification of the receipt of any third-party claim, relating to the Contract. County is entitled to recover its reasonable costs incurred in providing such notification.

ARTICLE 75. SUBSTITUTION OF SECURITY

In accordance with Public Contract Code Section 22300, the County will permit the substitution of securities for any moneys withheld by the County to ensure performance under the Contract. At the request and expense of the Contractor, securities equivalent to the amount withheld shall be deposited with the County, or with a state or federally chartered bank as the escrow agent, who shall then pay such moneys to the Contractor. Upon satisfactory completion of the Contract, the securities shall be returned to the Contractor.

ARTICLE 76. COMPLIANCE WITH STATE STORM WATER PERMIT FOR CONSTRUCTION

- a. Contractor shall be required to comply with all conditions of the State Water Resources Control Board (State Water Board) National Pollutant Discharge Elimination System General Permit for Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction Activity (Permit) for all construction activity which results in the disturbance of in excess of one acre of total land area or which is part of a larger common area of development or sale. Contractor shall be responsible for filing the Notice of Intent and for obtaining the Permit. Contractor shall be solely responsible for preparing and implementing a Storm Water Pollution Prevention Plan (SWPPP) prior to initiating Work. In bidding on this Contract, it shall be Contractor's responsibility to evaluate the cost of procuring the Permit and preparing the SWPPP as well as complying with the SWPPP and any necessary revision to the SWPPP. Contractor shall comply with all requirements of the State Water Resources Control Board. Contractor shall include all costs of compliance with specified requirements in the contract amount.
- b. Contractor shall be responsible for procuring, implementing, and complying with the provisions of the Permit and the SWPPP, including the standard provisions, monitoring and reporting requirements as required by the Permit. Contractor shall provide copies of all reports and monitoring information to the County's Construction Manager.
- c. Contractor shall comply with the lawful requirements of any applicable municipality, the County, drainage County, and other local agencies regarding discharges of storm water to separate storm drain system or other watercourses under their jurisdiction, including applicable requirements in municipal storm water management programs.
- d. Failure to comply with the Permit is in violation of federal and state law. Contractor hereby agrees to indemnify and hold harmless County, its Board members, officers, agents, employees and authorized volunteers from and against any and all claims, demands, losses or liabilities of any kind or nature which County, its Board members, officers, agents, employees and authorized volunteers may sustain or incur for noncompliance with the Permit arising out of or in connection with the Project, except for liability resulting from the sole established negligence, willful misconduct or active negligence of the County, its Board members, officers, agents, employees or authorized volunteers. County may seek damages from Contractor for delay in completing the Contract in accordance with Article 6 hereof, caused by Contractor's failure to comply with Permit.

ARTICLE 77. RESOLUTION OF CONSTRUCTION CLAIMS

- a. The following shall be applicable to all Claims:
 - 1) Definition of Claim: A "Claim" means a separate demand by the Contractor for (a) time extension, (b) payment of money or damages arising from work done by or on behalf of the Contractor pursuant to the Contract and payment of which is not otherwise expressly provided for or the claimant is not otherwise entitled to, or (c) an amount the payment of which is disputed by the County.
 - 2) Filing Claim is Not Basis To Discontinue Work: The Contractor shall promptly comply with work under the Contract or work requested by the County even though a written claim has been filed. The Contractor and the County shall make good faith efforts to resolve any and all claims that may arise during the performance of the work covered by this Contract.
- b. Procedure for Claims \$375,000 and Under:
 - 1) Any formal claim of \$375,000 and under shall be processed as follows in accordance with Public Contract Code Section 20104 et. seq.:
 - (a) Claims less than \$50,000. For claims less than Fifty Thousand Dollars (\$50,000.00), the County shall respond in writing to any written claim within forty-five (45) days of receipt of the claim, or may request, in writing, within thirty (30) days of receipt of the claim, any additional documentation supporting the claim or relating to defenses to the claim that the County may have against the Contractor. If additional information is thereafter required, it shall be requested and provided upon mutual agreement of the County and the Contractor. The written response of the County to the claim, as further documented, shall be submitted to Contractor within fifteen (15) days after receipt of the further documentation or within a period of time no greater than that taken by Contractor in producing the additional information, whichever is greater.
 - (b) Claims in Excess of \$50,000. For claims over Fifty Thousand Dollars (\$50,000.00), and less than or equal to Three Hundred Seventy-five Thousand Dollars (\$375,000.00), the County shall respond in writing to all written claims within sixty (60) days of receipt of the claim, or may request, in writing, within thirty (30) days of receipt of the claim, any additional documentation supporting the claim or relating to defenses to the claim that the County may have against the Contractor. If additional information is thereafter required, it shall be

requested and provided by mutual agreement of the County and the Contractor. The written response of the County to the claim, as further documented, shall be submitted to the Contractor within thirty (30) days after receipt of the further documentation, or within a period of time no greater than that taken by Contractor in producing the additional information or requested documentation, whichever is greater.

- 2) Informal Meet and Confer Conference: If Contractor disputes the written response of the County, or the County fails to respond within the time prescribed, Contractor may so notify the County, in writing, either within fifteen (15) days of receipt of the County's response or within fifteen (15) days of the failure of the County to respond within the time prescribed, respectively, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon a demand, the County shall schedule a meet and confer conference within thirty (30) days for settlement of the dispute.
- 3) Tort Claim: If following the meet and confer conference the claim or any portion remains in dispute, the claimant may file a claim pursuant to Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of the Title 1 of the Government Code. For purposes of that provision, the running of the period of time within which a claim must be filed shall be tolled from the time the claimant submits his/her written claim until the time the claim is denied, including any period of time utilized by the meet and conference.

c. Procedures for Civil Actions to Resolve Disputed Claims:

- 1) Non-binding Mediation: Within sixty (60) days, but no earlier than thirty (30) days, following the filing of a responsive pleading, the court shall submit the matter to non-binding mediation unless waived by mutual stipulation by both parties. The mediation process shall provide for the selection within fifteen (15) days by both parties of a disinterested third person as mediator, shall be commenced within thirty (30) days of the submittal, and shall be concluded within fifteen (15) days from the commencement of the mediation unless a time requirement is extended upon a good cause shown to the court. If the parties fail to select a mediator within the 15-day period, any party may petition the court to appoint the mediator.
- 2) Judicial Arbitration: If the matter remains in dispute, the case shall be submitted to judicial arbitration pursuant to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, notwithstanding Section 1141.11 of the code. The Civil Discovery Act of 1986 (Article 3 (commencing with Section 2016) of Chapter 3 of Title 3 of Part 4 of the Code of Civil Procedure) shall apply to any proceeding brought under this subsection consistent with the rules pertaining to judicial arbitration. Arbitrators shall be experienced in construction law.
- 3) Appeals: In addition to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of the Code of Civil Procedure), any party appealing an arbitration award who does not obtain a more favorable judgment shall, in addition to payment of costs and fees, also pay the attorneys' fees on appeal of the other party.
- 4) Interest: In any suit filed pursuant to Public Contract Code Section 20104.4, the County shall pay interest at the legal rate on any arbitration award or judgment. The interest shall begin to accrue on the date the suit is filed in the court of law.

d. Procedure for Claims Over \$375,000:

- 1) If a dispute in excess of a total value of \$375,000, arises out of, or relates to this Contract, or the breach thereof, and if said dispute cannot be settled through normal contract negotiations, the parties agree that as a condition precedent to the initiation of litigation, the dispute shall first be submitted to mediation pursuant to this Article 80. The mediation is voluntary, non-binding, and intended to provide an opportunity for the parties to evaluate each other's cases and arrive at a mutually agreeable resolution of the dispute. These provisions relating to voluntary mediation shall not be construed or interpreted as mandatory arbitration.
- 2) Either party may initiate mediation by notifying the other party or parties in writing. A Request for Mediation shall contain a brief statement of the nature of the dispute or claim, and the names, addresses, and phone numbers of all parties to the dispute or claim, and those, if any, who will represent them in the mediation.
- 3) The mediation process set forth in this Article shall be administered by the American Arbitration Association (AAA) and governed by their rules in effect at the time of filing, or by any other neutral organization agreed to by the parties (hereinafter called "Administrator").
- 4) The costs for all mediation, including the administrative fees and mediator compensation, will be shared equally by all parties. Fees shall be jointly negotiated by all parties directly with the Administrator. If all parties agree, then the mediation costs may increase as required for resolution of

the dispute. The expenses of witnesses for a party shall be paid by the party producing such witnesses.

- 5) A single mediator, acceptable to all parties, shall be used to mediate the dispute. The mediator will be knowledgeable in construction matters and will be selected from lists furnished by the Administrator. The initial mediation session shall commence within thirty (30) days of filing, unless otherwise agreed by the parties, or at the direction of the mediator.
 - 6) At least then (10) days before the first scheduled mediation session, each party shall provide the mediator a brief memorandum setting forth its position with regard to the issues that need to be resolved. At the discretion of the mediator, such memoranda may be mutually exchanged by the parties. At the first session, the parties will be expected to produce all information reasonably required for the mediator to understand the issue presented. The mediator may require each party to supplement such information.
 - 7) Mediation hearings will be conducted in an informal manner and discovery will not be allowed unless agreed to by all parties. All discussions, statements, or admissions will be confidential to the proceedings and will not be used for any other purpose as they relate to either party's legal position. There shall be no stenographic record of the mediation.
 - 8) Mediation sessions are private. The parties and their representatives may attend mediation sessions. Other persons may attend only with the permission of the parties and with the consent of the mediator. The parties may have an attorney present and shall advise the other parties no less than five (5) working days before the mediation of their intent to have an attorney present, so that the other parties may also have their attorneys present.
 - 9) The mediator does not have authority to impose a settlement on the parties but will attempt to assist the parties in reaching a satisfactory resolution of their dispute. The mediator is authorized to conduct joint and separate meetings with the parties and to make oral and written recommendations for settlement. Whenever necessary, the mediator may also obtain expert advice concerning technical aspects of the dispute, provided the parties agree and assume the expenses of obtaining such advice. Arrangements for obtaining such advice shall be made by the mediator or the parties, as the mediator shall determine.
 - 10) The mediator is authorized to end the mediation whenever, in the mediator's judgment, further efforts at mediation would not contribute to a resolution of the dispute between the parties.
 - 11) Any resultant agreements from mediation shall be documented in writing, as agreed upon during the mediation, and may be used as the basis for a change order or other directive as appropriate. All mediation results and documentation shall be non-binding and inadmissible for any purpose in any legal proceedings, unless such admission is otherwise agreed in writing by all parties. Mediators shall not be subject to any subpoena or liability and their actions shall not be subject to discovery in subsequent proceedings.
 - 12) The Mediation shall be terminated by the execution of a Settlement Agreement by the parties; by a written declaration of the Mediator to the effect that further efforts at Mediation are no longer worthwhile; or by a written declaration of a party or parties to the effect that the Mediation proceedings are terminated.
 - 13) If mediation is unsuccessful in resolving the dispute, the parties thereafter may agree to submit the matter to the Administrator for binding arbitration. The parties agree that the matter shall be submitted to one (1) arbitrator unless they agree to three (3) arbitrators in writing. The parties further agree that they will faithfully observe this Contract, and that the parties will abide by and perform any award rendered by the arbitrator(s), that a judgment of a court having competent jurisdiction may be entered upon the award, and that such judgment shall be enforceable as a final judgment to the fullest extent under the law. The parties agree to split evenly all arbitration and arbitrator(s)' fees and expenses. The arbitration shall be subject to, and proceed in accordance with Code of Civil Procedure, Section 1280 through 1294.2 if the parties do not agree to submit to binding arbitration, neither party is prevented from pursuing other legal remedies.
 - 14) Any arbitration, mediation or other forms of alternate dispute resolution shall be handled within the boundaries of the County unless otherwise mutually agreed.
- e. Rights and Remedies. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon Contractor by the General Conditions and amendments thereto and all of the rights and remedies available to County and Construction Manager/Architect thereunder, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by laws or regulations by special warranty or

guarantee or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

- f. Arbitration Award. Pursuant to Government Code Section 818, the Arbitrator shall have no jurisdiction to award punitive or exemplary damages.
- g. Attorney's Fees and Costs. In the event that any arbitration, action, suit or other proceeding is instituted to enforce any provision of this Contract, and/or to remedy, prevent, or obtain relief from a breach of this Contract, the prevailing party shall be entitled to recover all of its attorney's fees and costs incurred in each and every such arbitration, action, suit or other proceeding, including any and all appeals or petitions therefrom, except as may be provided to the contrary above. As used herein, attorney's fees shall be deemed to mean the full actual costs of any legal services actually performed in connection with the matters involved, calculated on the basis of the usual fees charged by the attorneys performing such services and shall not be limited to "reasonable attorney's fees" as defined by any statute or rule of court.

ARTICLE 78. INTEGRATION

- a. Oral Modifications Ineffective. No oral order, objection, claim or notice by any party to the other shall affect or modify any of the terms or obligations contained in any of the Contract Documents and none of the provisions of the Contract Documents shall be held to be waived or modified by reason of any act whatsoever, except by a waiver or modification thereof in writing and signed by the authorized representative of the County and the Contractor.
- b. Contract Documents Represent Entire Contract. The Contract Documents represent the entire understanding of the County and Contractor as to those matters contained therein, and no prior oral or written understanding shall be of any force or effect with respect to those matters covered by the Contract Documents.\

ARTICLE 79. COMPLIANCE WITH DTSC GUIDELINES—IMPORTED SOILS

If the Project requires the use of imported soils, the Contractor shall be responsible to use and shall certify that the imported material it uses is free of any hazardous and/or toxic substance or material of any nature or type as defined in accordance with California Law and the Health and Safety Code. The County reserves the right to reject any imported material that has come from agricultural or commercial land uses. Contractor must notify the County of the source of material and comply with any applicable Regional Water Quality Control Board Resolutions and when applicable, with the guidelines of the Department of Toxic Substances Control (DTSC).

ARTICLE 80. NOTICE OF TAXABLE POSSESSORY INTEREST

The terms of this document may result in the creation of a possessory interest. If such a possessory interest is vested in a private party to this document, the private party may be subjected to the payment of personal property taxes levied on such interest.

ARTICLE 81. MISCELLANEOUS

These Contract Documents shall be interpreted in accordance with the laws of the State of California. If any action is brought to interpret or enforce any term of these Contract Documents, the action shall be brought in a state or federal court situated in the County of Madera, State of California. Except as otherwise provided in these Contract Documents, in the event of any such litigation between the parties, the prevailing party shall be entitled to recover all reasonable costs incurred, including reasonable attorney's fees, as determined by the court.

END OF SECTION

SECTION 00 73 00
SUPPLEMENTARY CONDITIONS

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**SECTION 00 73 00
SUPPLEMENTARY CONDITIONS**

The following articles supersede the General Conditions as issued. When any article, paragraph or subparagraph is not modified or deleted by these Supplementary Conditions, the unaltered provisions of such Article, paragraph or subparagraph shall remain in effect.

ARTICLE SC-01 GENERAL

The Contractor will be provided, at Owner expense, with Five (5) sets of plans and specifications. Additional plans and specifications may be obtained at the Contractor's expense and upon forty-six (46) hour notice to the Architect.

ARTICLE SC-02 SPECIFICATIONS

- A. Where portions of these Specifications are written in imperative form, the imperative language is directed to the Contractor, unless specifically noted otherwise.
- B. Specification Paragraphs:
 - 1. Specification Paragraphs titled "Summary" or "Description of Work" is not intended to "scope" the Section nor imply a trade responsibility, but serve merely as a listing of significant items in the Section to allow the reader to quickly assess the Section content.
 - 2. Similarly, specification Paragraphs titled "Related Documents" are not intended to coordinate the Contractor's work, but merely indicate where certain other significant items which may be related to the work of the Section are indicated and/or specified.

ARTICLE SC-03 BUILDING PERMIT

Authority To Construct from San Joaquin Valley Air Pollution Control District will be obtained and paid for by the Owner. Building permit and other required permits are the responsibility of the Contractor. Reference the General Conditions.

ARTICLE SC-04 CODES AND REGULATIONS

All work, materials, and equipment shall be in full compliance with the California Building Code; California Plumbing Code; California Electrical Code; California Mechanical Code, California Fire Code, California Energy Code, with California Amendments, Cal/OSHA Safety Regulations; and all Federal, State and Local laws, ordinances, regulations, and Madera County Charter Provisions applicable in the performance of the work.

ARTICLE SC-05 UNDERGROUND SURVEY OF EXISTING UTILITIES

Prior to performing excavation activities, the Contractor shall contact Underground Service Alert (USA) 800-227-2600 and/or at their sole expense employ the services of a private locator to survey and ascertain the actual locations of existing underground utilities. Should the Contractor damage existing underground utilities during the prosecution of the work, they shall immediately notify the Architect in writing and diligently affect repairs to the damaged utility. The Contractor shall be responsible for all repairs and consequential damages resulting from utility outages cause as a result of the performance of their work.

ARTICLE SC-06 SCHEDULE OF OPERATION

- A. Time is of the essence in the performance of this Contract.
- B. The Owner shall issue to Contractor a Notice to Proceed designating the starting date on which Contractor shall begin work. The Contractor shall diligently prosecute the work from such date to completion within the time specified in the SUPPLEMENTARY CONDITIONS or any adjustments thereof.
- C. The Contractor shall not begin work in advance of receiving the Notice to Proceed.
- D. Construction activities shall be performed between the hours of 7:00 a.m. and 5:00 p.m., Monday through Friday. No work shall be performed outside the above hours without prior written authorization from the Owner.
- E. Construction activity that is disruptive to operations and adjoining spaces shall be minimized especially to all noise and vibration producing activities. Contractor shall plan to do disruptive work after normal business hours and shall coordinate and receive Owner approval prior to conducting work.

ARTICLE SC-07 CONTRACTOR COOPERATION

- A. Within the overall Project, the Contractor shall coordinate their work, as required, with the other contractors.
- B. The Contractor shall remove all debris, temporary facilities, or other items that may interfere with the other contractor's ability to perform their work.

ARTICLE SC-08 DAMAGE TO EXISTING WORK AND WORK OF OTHER CONTRACTORS

Damage to existing construction, equipment, planting, or to work of other contractors, by the Contractor in the performance of their work, shall be replaced or repaired and restored to original condition by the Contractor at the Contractor's expense.

ARTICLE SC-09 TRENCHING AND EXCAVATION

NOT APPLICABLE

ARTICLE SC-10 TRENCHES FIVE FEET OR MORE IN DEPTH

NOT APPLICABLE

ARTICLE SC-11 ABNORMAL WEATHER CONDITIONS

- A. The Contractor shall provide a Notice of Claim and a schedule fragnet submittal to the Architect for all time extension requests due to abnormal weather conditions. Should the Contractor fail to provide Notice of Claim and/or a schedule fragnet submittal for the weather event within the specified time limits, then it is mutually agreed that the weather event has no time impact on the contract completion date and no time extension is required. If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the scheduled construction as illustrated by a schedule fragnet.

A rain, windstorm, high water or other natural phenomenon of the specific locality of the work, which might reasonably have been anticipated from historical records of the general locality of the work, shall not be construed as abnormal weather conditions. The contractor shall anticipate the effect of the following rainfall totals provided by the Western Regional Climate Center during the development of the Project Schedule. No allowance for weather related contract time extensions will be considered until the following monthly totals have been surpassed and the adverse weather must have actually caused a delay in the completion of the project.

Avg. Total Precipitation (in.)/Month			
JAN	2.08	JUL	0.01
FEB	1.81	AUG	0.02
MAR	1.84	SEP	0.17
APR	1.13	OCT	0.62
MAY	0.44	NOV	1.30
JUN	0.10	DEC	1.71

After the anticipated adverse weather totals are exceeded, a contract time extension will be considered when adverse weather prevents work on critical activities for more than fifty percent (50%) of the scheduled workday. Upon experiencing critical path schedule impacts due to adverse weather conditions the Contractor shall seek a time extension in accordance with the Contract Modification Procedures.

ARTICLE SC-12 CERTIFICATES OF INSURANCE

- A. Before any Work commences at the Site, Contractor shall provide Owner with Certificates of Insurance, applicable endorsements, and Declarations pages for all insurance policies that Contractor and its Subcontractors are required to purchase and maintain.
 - 1. The Certificates of Insurance shall confirm (1) that respective affiliates, subsidiaries, directors, officers, partners, representatives, agents, and employees are insured under all required insurance policies (except professional liability and workers' compensation insurance policies) maintained by the Contractor and its Subcontractors, and (2) that the broker or agent issuing the Certificates is authorized by the insurance carrier to so represent.
 - 2. The Certificates of Insurance also shall evidence and attach copies of (1) the endorsements and other insurance requirements specified in the General Conditions, as modified by these Supplementary General Conditions, and (2) the Declarations page for each applicable policy.

3. Upon Owner's request, Contractor shall provide Owner with a complete copy of each insurance policy Contractor is required to purchase and maintain (including an explanation of any limitations or exclusions applicable to Owner as an "additional insured").
- C. If Contractor or its Subcontractors are required, by the General Conditions and these Supplementary General Conditions, to maintain insurance coverage beyond the expiration dates of the insurance policies indicated in any Certificates of Insurance provided to Owner, Contractor and its Subcontractors shall provide Owner with (a) written notice indicating replacement coverage for each expiring required insurance policy at least thirty (30) days prior to the expiration date of the applicable policy, and (b) within thirty (30) days after each new policy incepts, Contractor and its Subcontractors shall provide Owner with replacement Certificates of Insurance that evidence the required coverage, attach copies of required endorsements and Declarations pages, and otherwise comply with all insurance requirements contained in the General Conditions and these Supplementary General Conditions.
- D. Contractor's obligation to procure and maintain insurance (as specified in the General Conditions and these Supplementary General Conditions) are not, in any way, waived or excused by (1) Owner's failure to demand Certificates of Insurance, endorsements, or other evidence of Contractor or its Subcontractor's insurance coverage, (2) Owner's acceptance of Certificates of Insurance, endorsements, or other documents that do not fully comply with the insurance requirements, or (3) Owner's failure to identify a deficiency contained in the Certificates of Insurance, endorsements, or other evidence of insurance coverage provided by Contractor or its Subcontractor.
- E. By requiring such insurance and insurance limits herein, Owner does not represent that coverage and limits will necessarily be adequate to protect Contractor and such coverage and limits shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

ARTICLE SC-13 CONTRACTOR'S LIABILITY INSURANCE

- A. Contractor shall purchase and maintain, and shall cause each of its Subcontractors to purchase and maintain, such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's or Subcontractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
- B. The limits of liability for the insurance required by the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:
 1. Workers' Compensation, and related coverage under Article 25 of the General Conditions:

a. <u>Workers' Compensation</u> State: Labor Code b. <u>Employers' Liability</u> Each Accident: Disease - Policy Limit: Disease - Each Employee:	Amount required by the California <u>Minimum Limits</u> \$1,000,000 \$1,000,000 \$1,000,000
 2. General Liability Insurance under Article 27 of the General Conditions, shall include (1) broad form contractual liability coverage, (2) broad form property damage liability coverage, (3) personal injury coverage, (4) products liability and completed operations coverage, (5) cross-liability coverage, (6) premises and operations coverage and (7) independent contractors; and shall eliminate the exclusion with respect to property under the care, custody and control of Contractor:

a. <u>General Liability</u> General Aggregate: Products-Completed Operations: Personal & Advertising Injury: Each Occurrence (Bodily Injury and Property Damage): b. The General Liability coverage shall include an explosion, collapse and underground endorsement, including subsidence and any other earth movement ("XCU Coverage"). Owner's representative may waive XCU Coverage for Contractors which are not involved in excavation work.	<u>Minimum Limits</u> \$2,000,000 \$2,000,000 \$1,000,000 \$1,000,000

- c. The General Liability coverage, including completed operations coverage, must remain in effect through the applicable warranty period(s) and must include additional insured, as required herein.

3. The Contractual Liability coverage required by Article 27 of the General Conditions shall provide coverage for not less than the following amounts:

a.	Bodily Injury	Minimum Limits
	Each Accident	\$1,000,000
	Annual Aggregate	\$2,000,000
b.	Property Damage	Minimum Limits
	Each Accident	\$1,000,000
	Annual Aggregate	\$2,000,000

4. Automobile Liability under Article 28 of the General Conditions:

a.	<u>Automobile Liability</u>	<u>Minimum Limits</u>
	Company-owned Vehicles –	
	Combined Single Limit (any auto):	\$1,000,000
	Hired & Non-owned –	
	Combined Single Limit (any auto):	\$1,000,000
b.	Applicable to Hazardous Material Suppliers/Haulers: *	
	Company-owned Vehicles –	
	Combined Single Limit (any auto):	\$5,000,000
		(\$1,000,000 primary and \$4,000,000 in excess liability)

*Transporters Automobile Pollution & Remediation Legal Liability including coverage for loss, damage and cleanup costs caused by pollution arising from the transportation of hazardous materials by a covered automobile and arising out of the upset, overturn, collision, loading and unloading of materials.

5. Builder's Risk under Article 29 of the General Conditions:

a.	<u>Builder's Risk</u>	<u>Minimum Limits</u>
	Including Boiler and Machinery Coverage	Total Constructed Value
	Insuring All Risk of Physical Loss including	100% repair or replacement to full value of the property.
	Flood, Earthquake and Windstorm (Tornado)	

6. The following additional requirements may be added, as appropriate to a specific contract:

a.	Professional Liability/Errors & Omissions	Minimum Limits
	Each Claim:	\$2,000,000
	Annual Aggregate:	\$2,000,000
b.	Contractor's Pollution Liability	Minimum Limits
	Each Claim:	\$5,000,000
	Annual Aggregate:	\$5,000,000

D. Each liability policy required to be carried by Contractor and its Subcontractors shall name the County, their respective affiliates, subsidiaries, directors, officers, partners, representatives, agents, and employees as additional insured under the policy. The additional insured status shall be confirmed by endorsements, which shall be supplied to Owner along with the Certificates of Insurance and copies of the Declarations page for each policy pursuant to Article 30 of the General Conditions.

ARTICLE SC-14 TIME OF COMPLETION

A. Anticipated Dates: The anticipated dates of events are set forth below.

<u>EVENT DESCRIPTION</u>	<u>Anticipated Date</u>
1. Pre-Bid Conference	March 26, 2026

2.	Bid Date	April 16, 2026
3.	Project Award	June 2, 2026
4.	Notice to Proceed (NTP)	June 16, 2026

- B. Time of Completion Madera Library North Fork Branch Renovation 434 Calendar Days from NTP
- C. For each milestone, work shall be completed on or before the Finish-No-Later-Than time.
- D. When work of a milestone is completed, Contractor shall request inspection. Within five (5) days of receipt of request, the Construction Manager shall make a milestone inspection.
- E. If the Construction Manager determines that work of the milestone has been completed, the Construction Manager shall send a letter of certification to the Contractor. Such certification will not constitute acceptance but will establish conformity with the Contract for that portion of the Work included in the milestone subject to the following exceptions:
1. Delays in completion.
 2. Latent defects.
 3. Fraud, or such gross errors as amount to fraud.
 4. Willful misconduct or gross negligence.
 5. Subject to any guarantee or warranty, express or implied.
- F. If the Construction Manager determines that the Work of the milestone is not complete, Contractor will be notified. Construction Manager shall issue a list of deficiencies; or a notice stating work of the Milestone is not sufficiently complete to be inspected with a listing of the significant deficiencies.
- G. When work of the Milestone is completed, Contractor shall request another inspection.
- H. Work of the Milestone is considered complete only upon the completion of all punch list work and deficiencies.

ARTICLE SC-15 LIQUIDATED DAMAGES

- A. If, as determined by the Architect, work is not completed within the time specified or any adjustments thereof, damage will be sustained by the Owner. It is and will be extremely difficult and impracticable to determine the actual damage that the Owner will sustain by reason of such delay. Therefore, Contractor shall pay to Owner, as liquidated damages, the amount specified below. Owner may deduct liquidated damages from funds due or that become due to Contractor. Deductions for liquidated damages will be in addition to the five percent (5%) retention applied to progress payments.

B.

ARTICLE SC-16 CONTRACTOR'S WORKSITE STAFF

- A. Contractor's worksite staff shall give personal attention to the work and keep work under control and in conformance with the Contract.
- B. The Contractor shall maintain sufficient on-site personnel to effectively manage the work. The Contractor shall assign a minimum of four (4) different individuals, one (1) for each function, to be personally responsible for the following four (4) functions of work:
1. On-site project management (full-time or part-time)
 2. On-site supervision of construction (full-time)
 3. On-site engineering (part-time) Responsible for document control as needed for the project. Processes RFI's, submittals, daily reports, maintain as-built drawings, closeout documents, and other duties as required for the project. Supports Superintendent and Project Manager.
 4. On-site scheduling (part-time as needed)

If in the opinion of the Architect, the work is not being effectively managed the Architect may order the Contractor to augment or replace specific staff as necessary to ensure the successful completion of the project. Such personnel changes shall be at the sole expense of the Contractor.

ARTICLE SC-17 TEMPORARY FACILITIES

- A. The Contractor shall submit a project logistics plan to the Architect for approval within **fourteen (14) calendar days** from the Notice to Proceed date. The logistics plan shall define how Contractor plans to control site processes including, but not limited to, means and methods to accommodate temporary utilities, temporary facilities, site traffic, off-site parking, material delivery and material storage, etc.
- B. At the Contractor's option they may utilize suitable off-site storage facilities and/or lay-down areas to store materials. Fees paid for such off-site storage facilities and all costs associated with transportation of materials to or from the site shall be at the sole expense of the Contractor.
 - 1. Material Deliveries shall be scheduled so as to cause minimal disruption of adjacent businesses and normal traffic patterns on streets abutting the site.
 - 2. Construction Parking: No construction vehicle parking is provided. The Contractor shall limit the number of vehicles allowed on site to those vehicles necessary to perform the Work. Construction.
- C. Construction operations shall be confined to the site. Operations that encroach onto the public right of way shall be scheduled and performed either after 6:00 p.m. or on weekends and must be approved by the Architect in advance of the planned work. Detours and road closures will not be permitted for such operations.
- E. The Contractor shall make allowances for the continued use of the existing Madera County facilities and ongoing County operations.

ARTICLE SC-18 COUNTY'S INSPECTOR

- A. There will be a full time Inspector assigned to this project. Inspections will be made as requested by the Contractor and as required by the Contract Documents. 48-hour notice is required for any inspections.

ARTICLE SC-19 PROJECT SIGNAGE

- A. Contractor shall be responsible to provide, install, and maintain all required project signage. The location and content of project signage must be approved by the Construction Manager prior to installation.
- B. Under no circumstances shall Contractor or any of their Subcontractors be allowed to install or otherwise display advertising or similar signage without the express written consent of the Construction Manager.

END OF SECTION

SECTION 01 04 20

COORDINATION DRAWINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Furnish all labor, materials and services for all coordination drawings as indicated, in accord with provisions of Contract Documents.
 - 2. Completely coordinate with work of all other trades.
 - 3. Although such work is not specifically indicated, furnish, and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
- B. Coordination drawings: Produce and submit overlay drawings showing all horizontal and vertical dimensions for all underground utility work including vaults, utility work in and above ceilings, and in mechanical rooms. Avoid interference with structural framing, ceiling, partitions, and other services.
- C. Prior to start of work in any given area, each subcontractor shall approve, in writing, all coordination drawings affecting his/her work in that area.
- D. Any relocations required as a result of failure to resolve interferences, provide correct coordination drawings, or all attention to changes required in other work as a result of modifications to contract shall be paid for by the Contractor.
- E. Coordination meetings shall be scheduled by the General Contractor and coordinated with a Construction Manager.
- F. This Section of the Specifications is intended to ensure total coordination of all disciplines and is not intended to generally overlay drawings for all above ceiling areas. Areas of greatest complexity shall be addressed. Determination of areas to be addressed will be made with the Construction Manager during the scheduled coordination meetings. The selection of those specific areas to be addressed will not relieve the Contractor of coordination responsibility in all other areas of the facility.

1.03 PRODUCTION OF COORDINATION DRAWINGS

- A. General Contractor shall provide background drawings, showing partitions, ceiling heights, and structural framing locations and elevations, and existing obstructions.
- B. Resolve major interferences at initial coordination meeting prior to production of any drawings.

- C. Produce all initial coordination drawings within thirty (30) days after initial meeting. The General Contractor will arrange for production of said drawings not provided within that time.
- D. Meet as required to resolve interferences and correct coordination drawings.

1.04 AFTER APPROVAL

- A. After subcontractors' written approval of coordination drawings, mentioned used to resolve interferences not previously identified shall be determined by the General Contractor.
- B. All changes to approved coordination drawings approved in writing by the General Contractor prior to the start of work in the affected area.

1.05 PRECEDENCE OF SERVICES

- A. In event of conflicts involving location and layout of the work following priority will be used to resolve disputes. Structure has the highest priority:
 - 1. Structure
 - 2. Ceiling grid/tile/light fixtures.
 - 3. Gravity drainage lines.
 - 4. Large pipe mains.
 - 5. Ductwork/diffusers, registers and grilles.
 - 6. Sprinkler heads.
 - 7. Small piping and tubing/electrical conduit.
 - 8. Access panels.

1.06 SUBMITTALS

- A. See Section 01 33 00 for number and manner of submittals.

PART 2 - PRODUCTS (not used)

PART 3 – EXECUTION (not used)

END OF SECTION 01 04 20

SECTION 01 11 00

SUMMARY OF WORK

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 PROJECT DESCRIPTION:

- A. The Project Name: Madera County North Fork Branch Library Renovation
- B. Project Location: 32908 Rd 222, North Fork, CA 93643
- C. Owner: The County of Madera County, 200 W. Fourth Street, Madera, CA93637
- D. Architect: Jayson Architecture, 587 Shotwell St, San Francisco, CA 94110
- E. Construction Manager: Kitchell CEM, 2300 Tulare Street, Suite 100, Fresno, California, has been engaged as Construction Manager for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for Construction between Owner and Contractor, according to a separate contract between Owner and Construction Manager.

1.03.1 THE WORK CONSISTS OF:

- A. Renovation of the existing two-level structure to modernize the upper-level library and build out the currently unoccupied lower level. The project features a complete upgrade of all core infrastructure, including mechanical, electrical, plumbing, and sprinkler systems, alongside a new storm drainage system. On the building's exterior, the scope includes new roofing, siding, insulation, and windows, supported by updated waterproofing and weather barriers. Interior improvements consist of new partitions, casework, and high-quality finishes, while site work focuses on structural reinforcements, new retaining walls, and the installation of ADA-compliant parking and paths of travel.

1.04 CONTRACT

- A. The Work will be constructed under a single general construction contract.

1.05 CONTRACTOR'S USE OF PREMISES

- A. Contractor may be required to share use of Project site during construction period with contractors performing work under other contracts for construction of the overall Project and shall coordinate construction operations with those of other contractors., designated areas will be established for the shared use of the Contractor, and contractors performing work under other contracts. Contractor's use of premises is limited only by Owner's right to perform work or to obtain other contractors on portions of the Project.
- B. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
- C. Keep driveways and entrances serving the premises clear and available to the Owner and the public at all times. The Contractor is to provide and maintain free and clear access to areas

throughout the site for emergency services. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

- D. Repair and replace damaged existing construction to remain such as curbs, parking lot paving, roadways, site vegetation and utilities.

1.06 WORK UNDER OTHER CONTRACTS

- A. Contractor shall cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work of those contracts or work under this Agreement.

1.07 OWNER-FURNISHED, CONTRACTOR-INSTALLED (OFICI) PRODUCTS

A. Owners Responsibilities:

1. Provide submittals, product data, and installation manuals to the Contractor.
2. Arrange and pay for delivery of products to the project site in accordance with the Progress Schedule.
3. Jointly inspect delivered items with the Contractor to verify condition and quantities.

B. Contractor's Responsibilities:

1. Coordinate delivery dates with the Owner to prevent project delays.
2. Receive, unload, and handle products at the site.
3. Inspect for completeness and evidence of shipping damage at the time of delivery. If damage is found, notify the Construction Manager and Owner immediately in writing.
4. Provide secure, climate-controlled storage and protection for products until time of installation.
5. Install, assemble, and connect products (including final utility connections) as indicated in the Contract Documents.
6. Once installed, protect the finished items from damage by construction traffic or other trades.

1.09 COORDINATION OF SYSTEM START-UP

- A. Coordinate with Division 01 Specifications

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION (not used)

END OF SECTION 01 11 00

SECTION 01 20 00

ALTERNATES, UNIT COSTS, AND BASIS OF AWARD

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

- A. The administrative and procedural requirements outlined in this section govern the pricing and payment structures for the North Fork Library Renovation. This project utilizes a tiered bidding structure to accommodate multiple funding sources and budgetary decision-making. Specifically, this section defines the mandatory Base Bid Breakouts, which are essential components of the project scope required for separate agency funding. This section also defines the Basis of Award, which includes the Total Base Bid plus Alternate #1. Additionally, this section defines the Optional Alternates (#2 through #5), which are discrete scopes of work that the County of Madera may, at its sole discretion, elect to add to the contract following the determination of the low bidder.

1.02 BASIS OF AWARD:

- A. Determination of Low Bidder: The "Basis of Award" used to determine the lowest responsive and responsible bidder shall be the sum of the following:
 - 1. North Fork Branch Library Renovation
 - 2. UNIT Cost #1 (ADA Parking and Path of Travel Improvements).
 - 3. Bid Alternate #1 (South Deck).
- B. Owner's Rights: The County of Madera reserves the right to award the Contract based on the Total Base Bid alone, or the Total Base Bid plus any combination of Alternates, regardless of the Basis of Award calculation.

1.03 UNIT COST:

- A. Definition: Specific portions of the Base Contract scope that must be bid as a separate lump-sum line item for accounting and funding purposes. These items are mandatory and are included in the Basis of Award.

1.04 OPTIONAL ALTERNATES:

- A. Definition: Work items that the County may elect to add to the contract at its sole discretion.
- B. Alternate #1 Status: Alternate #1 is included in the Basis of Award for the purpose of identifying the low bidder, but remains optional for inclusion in the final executed contract.
- C. Alternates #2 - #5 Status: These items are not part of the Basis of Award.

1.05 SCHEDULE OF UNIT COSTS (FUNDED SEPARATELY)

A. UNIT COST #1: ADA Parking and Path of Travel Improvements (Lump Sum).

1.06 SCHEDULE OF ALTERNATES

A. Alternate No. 1: South Deck (INCLUDED IN BASIS OF AWARD).

B. Alternate No. 2: Meeting Room Glass Wall.

C. Alternate No. 3: Extended South Deck.

D. Alternate No. 4: Children's Room Glass Wall.

E. Alternate No. 5: Design-Build Irrigation.

PART 2 – PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 01 20 00

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply this Section.

1.02 SUMMARY:

- A. This Section specifies administrative and procedural requirements for handling requests for substitutions.
- B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section 01 33 00 "Submittal Procedures."
- C. Procedural requirements governing the Contractor's selection of products and product options are included under the General Conditions.

1.03 DEFINITIONS:

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents are considered requests for "substitutions." The following are not considered substitutions:
 - 1. Revisions to Contract Documents requested by the Owner or Architect.
 - 2. Specified options of products and construction methods included in Contract Documents.
 - 3. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.04 SUBMITTALS:

- A. Substitution Request Submittal: Requests for substitution will be considered if received within 60 days of NTP. Requests received by the Construction Manager outside of this timeline will not be considered.
- B. Submit electronic copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals Section 01 26 00 – "Contract Modification Procedures".
- C. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

1. Product Data, including Drawings and descriptions of products, fabrication, and installation procedures.
2. Samples where applicable or requested.
3. A detailed, side-by-side comparison of the significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include but is not necessarily limited to elements such as size, weight, durability, performance, and visual effect.
4. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors will become necessary to accommodate the proposed substitution.
5. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
6. Cost information, including a proposal of the net change, if any, in the Contract Sum.
7. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
8. The contractor warrants that he/she has investigated the proposed product and determined that it is equal to or superior in all respects to that indicated or specified.
9. The Contractor waives claim for additional costs and time associated with the proposed product, which may subsequently become apparent.
10. The Contractor shall provide a signed statement that the proposed product is in full compliance with the Contract Documents, and applicable regulatory requirements, requires no changes to specified controls and monitoring systems that may be specified in other Sections, and Certify that the contractor will be responsible for coordination at no additional cost to the Owner
11. The Contractor shall provide information on availability of maintenance service, and source of replacement materials, and provide a sample of Manufacturer's standard form of guarantee or warranty for proposed product.

D. **DELEGATED DESIGN AND ADMINISTRATIVE APPROVAL**

Certain systems, including Fire Sprinkler and Fire Alarm, are designated as Delegated Design. Per the Madera County Building Official, these items shall not be submitted to the Building Department as deferred submittals. Instead, the Contractor shall submit fully engineered shop drawings and calculations to the Architect and Engineer of Record for review and final approval. The A/E review shall constitute the final authorization for fabrication and installation. The Contractor is responsible for ensuring that all such designs strictly adhere to the performance specifications and the code-compliant design intent established in the permitted Master Set. Copies of the A/E-approved submittals must be maintained on the job site at all times for reference by the Field Inspector.

1.05 CONSTRUCTION MANAGER'S ACTION :

- A. Within one (1) week of receipt of the request for substitution, the Construction Manager will request additional information or documentation necessary for evaluation of the request. Within ten (10) days of receipt of the request, or one (1) week of receipt of the additional information or documentation, whichever is later, the Construction Manager will notify the Contractor of acceptance or rejection of the proposed substitution. The Architect at his/her sole discretion will determine the acceptability of proposed products and his/her determination shall be final. If a decision on use of a proposed substitution cannot be made or obtained within the time allocated, use the product specified by name in the Contract Documents.
- B. No consideration will be given to a substitute product unless, in the Architect's judgment, it complies with the following conditions.
 - 1. Substitution Request is complete.
 - 2. It is equal in quality, performance, and serviceability.
 - 3. Its use does not entail changes in details or related construction.
 - 4. It is acceptable in regard to design and aesthetic effect.
 - 5. There is cost, time or both, advantage to the Owner.
- C. Acceptance of a product shall not relieve the contractor from responsibility for the proper execution of the Work and any other requirements of the Contract Documents.
- D. If a proposed product is not accepted, use the product originally specified or indicated in the Contract Documents.
- E. No products other than those indicated or specified in the Contract Documents shall be purchased or incorporated in the Work without the Architect's prior written acceptance.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS:

- A. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise, requests will be returned without action except to record noncompliance with these requirements.
 - 1. Extensive revisions to Contract Documents are not required.
 - 2. Proposed changes are in keeping with the general intent of the Contract Documents.
 - 3. The request is timely, fully documented and properly submitted.
 - 4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
 - 5. The Specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 7. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or Separate Contractors, and similar considerations.
 8. The specified product or method of construction cannot be provided in a manner which is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
 9. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
 10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
- B. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents, does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART 3 - EXECUTION (not used)

END OF SECTION 01 25 00

SECTION 01 26 00
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections:
 - 1. Requests for Interpretation (RFI) are specified in Section 01 26 15.

1.02 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
 - 1. Proposal requests issued by the Architect are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.
 - 2. Unless otherwise indicated in the proposal request, within **10- calendar days** of receipt of the proposal request, submit to the Architect for review an estimate of cost necessary to execute the proposed change.
 - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.
- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change.
 - 1. Include a statement outlining the reasons for the change 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 Contract Time.
 - 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Comply with requirements in Section 01 25 00 if the proposed change in the work requires the substitution of one product or system for a product or system specified.
 - 5. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests or a form furnished by the Owner's Representative.
- C. Supplemental Instructions from the Architect (ASI): Use AIA Form G710 or a form furnished by the Owner's Representative.

1.03 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change

Directive on AIA Form G714 or other form furnished by the Owner's Representative, instructing the Contractor to proceed with a change in the work, for subsequent inclusion in a Change Order.

1. The Construction Change Directive will contain a complete description of the change in the work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
- C. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.04 CHANGE ORDER PROCEDURES

- A. Upon the Owner's Representative's approval of a Change Order Proposal Request, the Contractor shall issue a Change Order for signatures of the Owner or Owner's Representative, Architect, and Contractor on AIA Form G701 or other form furnished by the Owner's Representative, as provided in the Conditions of the Contract.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION 01 26 00

SECTION 01 26 13

REQUEST FOR INFORMATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY:

- A. This Section specifies administrative and procedural requirements for Request for Information (RFI), including:
 - 1. Definitions
 - 2. The Request for Information Procedure
 - 3. Request for Information Review System

1.03 DEFINITIONS:

- A. General: To prevent misunderstanding between the Owner and the Contractor over project procedures, the following definitions are provided:
 - 1. Contract Document Clarification: An answer from the Construction Manager and/or Architect, in response to an inquiry from the Contractor, intended to make some requirement(s) of the Contract Documents clearly understood. Contract Documents clarifications may be sketches, drawings, or in narrative form and will NOT change any requirements of the drawings or plans. Responses to Contractor inquiries shall be outlined elsewhere in this Section.
 - 2. Project Communications: Routine written communications between the Owner and the Contractor shall be in letter, field memo or fax format. All such communications shall be processed through the Construction Manager and shall NOT be identified as Request for Information, nor shall they substitute for any other written provisions of these Contract Documents.
 - 3. Requests for Information: A written request from the Contractor to the Owner, seeking an interpretation or a clarification of some requirement of the contract documents. The Contractor shall clearly and concisely set forth the issue for which he/she seeks clarification or interpretation and why he/she believes a clarification is needed. Responses from the Owner will not change any requirements of the Contract Documents. Responses to Contractor inquiries shall be outlined elsewhere in this section.
 - 4. Submittals: Refer to Section 01 33 00 "Submittals".
 - 5. Construction Schedule Submittals: Refer to Section 01 32 00 "Construction Progress Documentation".

1.04 THE REQUEST FOR INFORMATION PROCEDURE

A. General: The following establishes the process and timing concerning RFI's and their responses:

1. In the event that the General Contractor or Subcontractor, at any tier, determines that some portion of the Contract Documents requires clarification or interpretation by the Architect, the General Contractor shall submit a Request for Information in writing to the Construction Manager. The written request shall be clearly titled "REQUEST FOR INFORMATION," in capital letters. Requests for Information may only be submitted by the General Contractor. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the Owner.
 2. The Construction Manager will review all Requests for Information to determine whether they are Requests for Information within the meaning of this term. If the Construction Manager determines that the document is not a Request for Information, it will be returned to the Contractor, unreviewed as to content, for resubmittal in the proper manner.
 3. Responses to Requests for Information shall be issued within fourteen (14) calendar days of receipt of the request from the Contractor unless the Construction Manager determines that a longer time is necessary to provide an adequate response. The Contractor shall not be entitled to any time extension due to the time it takes the Construction Manager to respond to the request provided that the Construction Manager responds within the fourteen (14) working days set forth above.
1. Responses from the Construction Manager will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a Request for Information will cause a change to the requirements of the Contract Documents, the Contractor shall immediately give written notice to the Construction Manager Owner stating that the Contractor considers the response to be a change in scope of work. Failure to give such written notice immediately shall waive the Contractor's right to seek additional time or cost under the Changes article found in the General Conditions.

1.05 THE REQUEST FOR INFORMATION REVIEW SYSTEM

- A. General: All documents labeled as RFI will be reviewed by the Construction Manager to determine whether or not the document meets the definition of an RFI, as stated previously. If the document submitted is an RFI, the document will be entered into the RFI Log and processed for a response.
- B. If the document submitted is not an RFI, it will be returned to the Contractor immediately with a standard letter of transmittal stating the following:

"This document is not an RFI and therefore is being returned to you without a response. This document has not been entered into the project's RFI Log. Resubmit document in the proper format as (circle one) Project Communications, Submittals, Substitution, Schedule Submittal or other, for processing."

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 01 26 13

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
 - 1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.
- B. The Contractor's Construction Schedule requirements are included in Section 01 32 00, "Construction Progress Documentation"; and Submittal Schedule requirements are included in Section 01 33 00, "Submittals".

1.03 SCHEDULE OF VALUES

- A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule. See Section 01 32 00 "Construction Progress Documentation" for additional information.
 - 1. Within thirty (30) calendar days after the Award of Contract, the Contractor shall submit Schedule of Values for review by Construction Manager, allocating a dollar value for each activity on the Construction Schedule.
- B. Format and Content: Use the Construction Schedule as a guide to establish the format for the Schedule of Values.
 - 1. Identification: Include the following identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of the Owner.
 - c. Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
 - a. Generic name.
 - b. Related Specification Section.

- c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that have affected value.
 - g. Dollar value.
 - h. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total one hundred (100) percent.
3. The Schedule of Values shall be a product of the CPM Schedule and provide sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. The following information shall be minimally illustrated in the Schedule of Values and be subject to approval by the Construction Manager.
- a. Dollar value for each activity will be cost including labor and materials. The dollar value of the General Conditions as well as Overhead and Profit shall be dispersed equally throughout the CPM Schedule activities.
 - b. Make sum of activity costs equal the Contract Amount.
 - c. Separate line items for General Conditions and may be required *by the Owner*.
4. Component amounts shall be rounded off to the nearest whole dollar, and the cumulative total thereof shall equal the Contract Amount.
5. All material storage will be the responsibility of the contractor.
6. The CPM Schedule shall be progressed in accordance with the General Requirements Section "Construction Progress Documentation" 01 32 00 and the schedule update shall be utilized as the basis for the Contractor's Application for Payment.

1.04 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as reviewed by the Owner, Construction Manager and Architect, and paid for by the Owner. See General Conditions for additional information regarding progress payments and final payment.
 - 1. The initial Application for Payment, the Application for Payment at time of Completion, and the final Application for Payment involve additional requirements as listed below.
 - 2. Contractor to submit cash flow analysis quarterly as required for reporting to Board of Corrections.
- B. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application or Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use AIA Document G702 and Continuation Sheets G 703 as the form for Application for Payment.

- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Contractor. Incomplete applications will be returned without action.
1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
 2. Include amounts of Change Orders issued prior to the last day of the construction period covered by the Application.
- E. Transmittal: Submit three (3) executed copies of each Application for Payment to the Construction Manager by means ensuring receipt within twenty-four (24) hours; one (1) copy shall be complete, including waivers of lien and similar attachments, when required.
1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Construction Manager.
- F. Waivers of Mechanics Lien and Stop Notice: With each Application for Payment, submit waivers of mechanics lien and stop notices from every entity who may lawfully be entitled to file a mechanics lien or stop notice arising out of the Contract, and related to the Work covered by the payment.
1. Submit partial waivers on each item for the amount requested on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
- G. Initial Application for Payment: Administrative actions and submittals that must precede the submittal of the first Application for Payment include the following:
1. List of subcontractors, including names, addresses, and contact persons.
 2. List of principal suppliers and fabricators.
 3. Schedule of Values.
 4. Contractor's Construction Schedule (preliminary if not final).
 5. Submittal Schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. List of Contractor's principal consultants.
 8. Copies of authorizations and licenses from governing authorities for performance of the Work.
 9. Initial survey and damage report.
- H. Final Payment Application: Administrative actions and submittals which must precede submittal of the final payment Application for Payment include the following:

1. All pertinent permits and similar approvals such as Board of Corrections / State Fire Marshal / Division of Forestry, Department of Health and Environmental Services, SJVAPCD, and RWQCB sign-off.
2. Warranties (guarantees) and maintenance agreements.
3. Test/adjust/balance records.
4. Maintenance instructions.
5. Start-up performance reports.
6. Change-over information related to Owner's occupancy, use, operation, and maintenance.
7. Final cleaning.
8. Extra materials.
9. Application for reduction of retainage, and consent of surety.
10. Completion of Project closeout requirements.
11. Completion of items specified in order to achieve Completion.
12. Assurance that unsettled claims will be settled.
13. Transmittal of required Project construction records to Owner.
14. Proof that taxes, fees and similar obligations have been paid.
15. Removal of temporary facilities and services.
16. Removal of surplus materials, rubbish and similar elements.
17. Ensure Owner's exclusive access.
18. Sign off sheets for wastewater treatment tracking conducted by contractor.
19. Post Warranty Bond in the amount of ten (10%) percent of Final Contract Amount.

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION (not used)

END OF SECTION 01 29 00

SECTION 01 31 13

PROJECT COORDINATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY:

- A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
 - 1. General project coordination procedures.
 - 2. Conservation.
 - 3. Coordination Drawings.
 - 4. Administrative and supervisory personnel.
 - 5. Project meetings.
 - 6. General installation provisions.
 - 7. Cleaning and protection.

1.03 Progress meetings, coordination meetings and pre-installation conferences are included in Section 01 31 19 – Project Meetings.

1.04 Requirements for the Contractor's construction schedule are included in Section 01 32 00- Construction Progress Documentation.

1.05 COORDINATION:

- A. Coordination: Coordinate construction activities included under various sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
- B. Each contractor shall coordinate his/her construction operations with those of other contractors and entities, including those performing work under other contracts, to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate his/her operations with operations included in different sections that depend on each other for proper installation, connection, and operation. Special attention is given to Section 01 11 00 – Summary of Work, regarding Contractor's use of premises and work to be performed under separate contracts.
- C. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

- D. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
- E. Make adequate provisions to accommodate items scheduled for later installation.
- F. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
- G. Requirements for coordination drawings are included in Section 01 04 20 – Coordination Drawings.

1.06 ADMINISTRATIVE PROCEDURES

A. Coordinate scheduling and timing of required administrative procedures with other construction activities, including those of other contracts, to avoid conflicts and 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. Pre-installation conferences.
 - 7. Project closeout activities.
- B. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water and materials.
- C. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

1.07 SUBMITTALS:

- A. Staff Names: Within fifteen (15) days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the Project site; identify individuals, their duties, and responsibilities; list their addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION PROVISIONS:

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with the manufacturer's installation instructions and recommendations, to the extent that these instructions and recommendations are more explicit or more stringent than requirements contained in Contract Documents.
- C. Verify characteristics of interrelated assemblies and equipment for compatibility. Coordinate Work having independent responsibilities for installation connection, or servicing access.
- D. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- E. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.
- F. Visual Effects: Provide uniform joint width in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Construction Manager for final decision.
- G. Recheck measurements and dimensions, before starting each installation.
- H. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- I. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- J. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Construction Manager for final decision.

3.02 CLEANING AND PROTECTION:

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration prior to Final Acceptance.
- B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging or otherwise deleterious exposure during the construction period.
- D. Execute periodic cleaning to keep Work, Site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations. Leave the work "broom clean".
- E. Provide onsite containers for collection of waste materials, debris, and rubbish.

- F. Remove waste materials, debris, and rubbish from site periodically and as often as necessary to maintain an orderly construction site and dispose of at legal disposal areas away from site.
- G. Do not allow trash containers to overflow.
- H. Clean interior spaces prior to start of finish painting and continue cleaning on as-needed basis until painting is finished.
- I. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

END OF SECTION 01 13 31

SECTION 01 31 19

PROJECT MEETINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 PRECONSTRUCTION CONFERENCES

- A. Prior to commencement of work, a pre-construction conference will be held to discuss procedures to be followed during the progress of the Work. The meeting will be scheduled after execution of the agreement and prior to commencement of work.
- B. Location: To be determined by Construction Manager.
- C. Attending shall be:
 - 1. Construction Manager
 - 2. Architect and his/her professional consultants, as needed
 - 3. Contractor
 - 4. Contractor's Superintendent
 - 5. Major subcontractors
 - 6. Owner Representatives
 - 7. Others as appropriate
- D. Agenda: Following is suggested agenda. Actual agenda will be prepared and distributed by Construction Manager prior to meeting:
 - 1. Introductions
 - 2. Distribution and discussion of:
 - a. List of major subcontractors and suppliers
 - b. Projected Construction Schedules
 - 3. Critical work sequencing and reiteration of contract obligation toward meeting milestones.
 - 4. Major equipment deliveries and priorities.
 - 5. Project Coordination.
 - 6. Designation of responsible personnel.

7. Procedures and processing of:
 - a. Correspondence
 - b. Submittals
 - c. Field Orders and clarifications
 - d. Proposal requests and quotations
 - e. Change Orders and Work Authorizations
 - f. Applications for Payment
 - g. Requests for Information
8. Procedures for maintaining Record Documents
9. Use of premises:
 - a. Office, work and storage areas
 - b. Owner requirements
10. Construction facilities
11. Temporary utilities
12. Security considerations
13. Housekeeping and clean-up procedures
14. Insurance requirements
15. Wage and hour compliance
16. Noise and dust control
17. Testing and Inspection
18. Survey control
19. Other Subjects as appropriate

1.03 PROGRESS MEETINGS

- A. The Construction Manager will schedule and hold meetings weekly. The General Contractor will prepare Agenda for such meetings and distribute to the interested parties at the next successive meeting.
- B. Location: Contractor's field office or other acceptable location. Time and location of the meeting will be determined during the Pre-construction Conference.

- C. Attending shall be:
1. Construction Manager
 2. Contractor
 3. Contractor's Superintendent
 4. Subcontractors, as appropriate to the Agenda
 5. Suppliers, as appropriate to the Agenda
 6. Owner, as needed
 7. User Department representatives as needed
 8. Architect, and his/her professional consultants as needed
 9. Others, as appropriate to the Agenda
- D. 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 current status of the Project.
1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule.
 - a. 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 such items as:
 - a. Interface requirements
 - b. Time
 - c. Sequences
 - d. Deliveries
 - e. Off-site fabrication problems
 - f. Access
 - g. Site utilization
 - h. Temporary facilities and services
 - i. Hours of work
 - j. Hazards and risks (Contractor's Responsibility)

- k. Housekeeping
 - l. Quality and work standards
 - m. Change Orders
 - n. Documentation of information for payment requests
 - o. RFI's
 - p. Submittals
 - q. Correction Notices
 - r. Disputed items
- 3. Reporting: No later than each successive meeting, Construction Manager will distribute copies of minutes of the meeting to each party present. Included will be a brief summary, in narrative form, of progress since the previous meeting and report.
 - 4. Schedule Updating: Contractor to revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.04 QUALITY ASSURANCE / QUALITY CONTROL MEETINGS

- A. The Construction Manager will schedule and hold meetings weekly. Construction Manager will prepare Agenda for such meetings and distribute to the interested parties at the next successive meeting.
- B. Location: Contractor's field office or other acceptable location. Time and location of the meeting will be determined during the Pre-construction Conference.
- C. Attending shall be:
 - 1. Construction Manager
 - 2. Contractor
 - 3. Contractor's Superintendent
 - 4. Subcontractors, as appropriate to the Agenda
 - 5. Owner, as needed
 - 6. Architect, and his/her professional consultants as needed
 - 7. Inspector of Record
 - 8. Others, as appropriate to the Agenda
- D. Agenda: Review deficiencies in construction work and set deadlines to complete the deficient work. Deficiencies to be reviewed will have been noted by the Inspector of Record, Testing Laboratory,

Construction Manager, Contractor and its subcontractors. Progress will be tracked by the Construction Manager and reviewed weekly by all parties.

1. Reporting: No later than each successive meeting, Construction Manager will distribute copies of minutes of the meeting to each party present. Included will be a brief summary, in narrative form, of progress of each deficient item since the previous meeting and report.
2. Deficiency Corrections: In addition to the other requirements of the contractor's contract with the County of Madera for this Project, contractor will make every effort to have each deficiency expedited in a manner that will not delay the Work. If the contractor fails to complete the deficiencies in a timely manner that results in delays to the Project Schedule, contractor shall fully bear the time and cost impacts of such actions.

1.05 PROGRESS PAYMENT MEETINGS

- A. Schedule and hold a billing meeting each month prior to submittal of Application for Payment. Billing meetings shall coincide with last of month progress meeting, whenever possible.
- B. Location: Contractor's field office or other acceptable location.
- C. Attending shall be:
 1. Construction Manager
 2. Architect, as needed
 3. Contractor
 4. Owner, as needed
- D. Prepare an itemized draft of the month's proposed billing for review with the Construction Manager, Architect and Owner at the billing meeting. Refer to Section 01 29 00 – Payment Procedures, for further requirements.
- E. Following review of the proposed billing, revise as required, prepare Application for Payment, and submit to the Construction Manager. The Construction Manager will certify and forward it to the Owner, who will authorize payment upon receipt of partial waivers of lien from the Contractor and all Subcontractors for previous payment.

1.06 PRE-INSTALLATION CONFERENCES

- A. Contractor shall convene a pre-installation conference for items of work contained in each division of the specifications, each trade within the division, and each subcontractor within the division.
 1. Contractor shall convene a pre-installation conference prior to commencing the Work of the section, trade, or subcontractor.
 2. Contractor shall require attendance of each subcontractor and each trade directly affecting or affected by the Work within the division.
 3. Construction Manager, Architect and Owner may attend pre-installation conferences.

4. Contractor shall convene additional conferences when required by individual section of the specification.
5. Contractor shall prepare an agenda, preside over the conference, and record minutes, and distribute copies within two (2) days after the conference to participants, with three (3) copies to the Construction Manager.
6. At a minimum, Contractor shall review conditions of installation, coordination, preparation, approved submittals, contract documents, schedule, testing and inspection, and means and methods planned to be used to perform the work.
7. Within ten (10) days after Notice to Proceed, submit a proposed list of pre-installation conferences, the approximate dates of the conferences, and items of work to be covered, for approval by the Construction Manager. Provide the Construction Manager with the actual date, time, and location of each conference at least one (1) week in advance of each conference.

1.07 GUARANTEE/WARRANTIES, BONDS, AND SERVICE AND MAINTENANCE CONTRACTS REVIEW MEETING

- A. Eleven (11) months following date of Notice of Completion, hold a meeting for the purpose of review of guarantees/warranties, bonds, and service and maintenance contracts for materials and equipment. Take action as appropriate to implement repair or replacement of defective items, and to extend service and maintenance contracts.
- B. Attending shall be:
 1. Construction Manager
 2. Architect
 3. Owner's and Architect's Consultants, as appropriate
 4. Contractor
 5. Subcontractors, as appropriate to the Agenda
 6. Suppliers, as appropriate to the Agenda
 7. Others, as appropriate to the Agenda
 8. Owner

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION (not used)

END OF SECTION 01 31 19

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY

- A. This 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. Short Interval Schedule
 - 3. Contractor Reports
- B. Related Sections include the following:
 - 1. General Requirements Section xxx - "Project Coordination" for submitting and distributing meeting and conference minutes.
 - 2. General Requirements Section xxx - "Submittals " for submitting schedules and reports.
 - 3. General Requirements Section xxx - "Quality Requirements" for submitting a schedule of tests and inspections.
 - 4. General Requirements Section xxx - "Project Closeout" for submitting Project Record Documents at Project closeout.
- C. Requirements for Critical Path Method "CPM" scheduling are included to insure adequate planning and execution of the Work and to assist the Owner in evaluating progress of the Work economically and chronologically.
- D. The Contractor shall be solely responsible for establishing the schedule for the Work and shall be responsible for such schedule to be consistent with meeting the contract milestone and completion dates as established by the Owner.
 - 1. The Contractor shall develop a CPM Schedule demonstrating fulfillment of all contract requirements. The project schedule shall be kept current to be utilized for scheduling, coordinating, monitoring work progress, and for preparation of the monthly application for payment under this Contract including all work of Subcontractors and equipment and material suppliers.
 - 2. Schedule shall include activities pertaining to submission of product data and sample submittals and shop drawings, fabrication and delivery times, and these schedule activities shall be linked to the start of the correspondent work activity.
- E. Contractor shall designate a Scheduling Representative who is trained and experienced in compiling construction scheduling data, in analyzing scheduling data by use of CPM, and in preparation and issuance of periodic reports as required herein. The Contractor's Scheduling Representative shall have direct control and complete authority to act on behalf of the Contractor regarding the fulfillment of all project schedule requirements.

1.03 QUALITY ASSURANCE

- A. The following publication is cited as reference for CPM and scheduling techniques utilized in this Contract:

1. J.J. Moder & C.R. Phillips, Project Management with CPM & Pert. New York: Reinhold Publishing Corp.
- B. All schedule and report work shall use a computer-based CPM, compatible with Primavera Suretrak Construction manager (for Microsoft Windows).
- C. All schedule submittals shall include a minimum of one (1) reproducible, three (3) prints, with an electronic copy of the current schedule.

1.04 INTERIM SCHEDULE

- A. Within twenty-one (21) calendar days after Notice to Proceed and prior to submission of the first payment request, the Contractor shall submit to the Construction Manager a practical ninety (90) calendar day Interim Schedule. The Interim Schedule shall reflect the following information:
 1. Procurement, submittals, construction drawings, shop drawings, approvals, fabrication and delivery of all major and long lead equipment and material items.
 2. Work expected to occur within the first ninety (90) calendar days of the project, consistent with meeting all established milestone and completion dates.
 3. The Interim Schedule shall be descriptive of the Work to be performed so that the Contractor and the Construction Manager can easily monitor progress of the Work. All work activities shall be manpower and cost loaded and will be the basis for payment during the beginning months of the project.
 4. Within fifteen (15) calendar days after receipt of the Interim Schedule, the Construction Manager will notify the Contractor of the approval or disapproval of the Interim Schedule. In the event of disapproval, the Contractor shall resubmit the schedule within seven (7) calendar days. No progress payments will be made for work in progress or completed or submittals reviewed until the Interim Schedule is approved.

1.05 OFFICIAL CONTRACT SCHEDULE

- A. The CPM Schedule to be prepared by the Contractor pursuant to this Section will be a part of a total system for scheduling, reporting work progress, and preparing the monthly payment application.
- B. Within sixty (30) calendar days after the Notice to Proceed, the Contractor shall submit to the Construction Manager four (4) original full-size prints, and one (1) electronic copy of the complete Contract Schedule for approval or disapproval. In the event the complete Contract Schedule is disapproved, the Contractor shall resubmit a corrected schedule within fifteen (15) calendar days after the notice of disapproval is received by the Contractor.
- C. Should the Contract Schedule not be accepted within ninety (90) calendar days after Notice to Proceed, the Contractor may be due provisional progress payments(s) on work performed, based on the Interim Schedule. It is the responsibility of the Contractor to reconcile such cost information and payments with the Contract Schedule. However, no payment shall be approved, or submittals reviewed after the ninety (90) calendar day period, until the Contract Schedule has been accepted by the Owner.
- D. The approved Interim Schedule shall be incorporated into the final Contract Schedule and shall represent the initial ninety (90) calendar days of the Contract Schedule.
- E. The initial submittal of the Contract Schedule shall not reflect contract changes or delays. These changes shall be added within the first (1st) schedule revision.
- F. The initial submittal of the Official Contract Schedule shall include, in addition to construction activities, the following:
 1. The submittal and review of construction drawings, shop drawings and materials, the procurement and fabrication of major materials and equipment, and their installation and testing.

2. Contract requirements dates of all or parts of the Work will be shown including all activities of the Owner that affect the progress of the Work.
 3. Activities of completed work ready for use by next trade, etc.
 4. Activities relating to different areas of responsibility, such as sub-contracted work, which is distinctly separate from that being done by Contractor directly.
 5. Different categories of work as distinguished by craft or crew requirements.
 6. Different categories of work as distinguished by materials.
 7. Distinct and identifiable subdivisions of work such as structural slabs, beams, or columns.
 8. Location of work within the project that necessitates different times or crew to perform.
 9. Outage schedules of limiting times that existing utility services may be interrupted to construct the Project.
 10. Include punch list and Mechanical, Piping, and Electrical (MPE) system(s) flush, testing, balance, and maintenance personnel training.
 12. Acquisition and installation of equipment and materials supplied and/or installed by Owner or separate contractors.
 13. No activity shown on the CPM schedule shall have a duration in excess of twenty (20) calendar days, except passive activities such as curing. The Contractor will be responsible for dividing the Work under the Contract to accommodate this requirement.
- G. Major Equipment/Materials: For all major equipment and materials fabricated or supplied for Project, Construction Schedule shall show a sequence of activities including:
1. Preparation of shop drawings and sample submissions.
 2. Review of shop drawings and samples.
 3. Shop fabrication, delivery, and storage.
 4. Erection or installation.
 5. Test of equipment and materials.
 6. Required dates of completion.
- H. Completion: Construction Schedule shall show a completion date for the Work that is no later than the required date for completion.
- I. Construction activities shall be delineated separately for off-site work, site development, earthwork, utilities, roads, parking lots, fences, and each structure, and shall incorporate all milestones.
- J. The network diagrams shall clearly indicate any work that is planned to be accomplished on a work schedule other than eight (8) hours per day and forty (40) hours per week.
- K. The basic concept of CPM network diagramming will be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of following activities. The diagrams shall show a continuous flow from left to right with no right to left sequences.
- L. The following information will be provided in a report for each network activity:
1. Activity description.
 2. Activity duration in workdays.
 3. Activity cost. The Contract Amount shall be broken down with the appropriate values distributed to the network diagram activities.

4. Working activities and General Conditions activities shall be identified separately.
 5. Estimated manhours for each activity.
 6. Activity predecessors.
 7. Activity successors.
 8. Activity logic ties.
- M. The Contractor shall provide to the Construction Manager their schedule data together with associated costs. Schedule information provided by the Contractor shall support milestone and completion dates specified in the contract documents, and the sum of the network activity costs shall equal the total contract price.
- N. Schedule review by the Owner and its agents is limited to ensuring the logic of sequencing is reasonable and Contractor has demonstrated ability to meet contractual milestone and completion dates. Review of schedule should not be construed as direction from the Owner or its agents to Contractor on how to schedule the work.
- O. Subsequent to approval of the contract schedule, the Contractor will provide one (1) reproducible sepia copy of the network diagrams and one (1) electronic copy, plus copies of all supporting documents (Contract Price, Schedule of Values, breakdown, etc.) Monthly update data will be submitted in the same form and numbers. Size of network diagrams for each sheet shall be no larger than thirty inches by forty-two inches (30" x 42") or as approved by the Construction Manager.
- P. After Completion and Acceptance of the Official Contract Schedule: The Contractor will provide computer reports thereafter, as follows:
1. CPM Schedule Reports: The Contractor shall submit copies of Activity, Logic, Total Float, and Earnings CPM reports concurrent with the CPM Schedule updates.

Activity Report: List of all activities sorted by activity number and then early start or actual start date.

Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start or actual start date.

Total Float Report: List of all activities sorted in ascending order of total float.

Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until the most recent Application for Payment.

The format for each report shall contain the following information for each activity:

 - a. Activity Number
 - b. Activity Description
 - c. Original Duration in days
 - d. Estimated remaining duration in days
 - d. Early and late finish dates
 - e. Percentage of each activity completed as of each report
 - f. Remaining float/days behind schedule
 - g. Responsibility for activity
 - h. Current status of activity as compared to baseline schedule
 2. Earnings / Cost Reports: Initial and subsequent Cost Reports will include the following formation for each activity, sorted by trade activity:
 - a. Activity Number

- b. Activity Description
- c. Percentage of value of Work in place against total value
- d. Total cost of each activity
- e. Value of Work in place since last report
- f. Value of Work in place to date
- g. Value of incomplete Work

1.06 SHORT INTERVAL SCHEDULES

- A. Three (3) Week Window: At each weekly progress meeting, the Contractor shall produce a detailed three (3) week window of the current schedule, indicating activities scheduled for the current and following weeks.

1.07 PAYMENT PROGRESS REPORTING

- A. Construction Manager and Contractor shall select a specified time for updating the Project Schedule at the jobsite each month.
 - 1. The Construction Manager and Contractor and their designated scheduling representatives will attend the meeting to review the project progress.
 - 2. The Contract Schedule shall be the basis for monthly pay requests derived from the joint review of the cost loaded schedule.
 - 3. All progress and status information provided by the Contractor shall clearly define the reporting period for which the status is provided.
- B. At the monthly progress review meeting, the Contractor will provide "actual start" and "actual completion" dates for activities that were started or completed during the reporting period. The Contractor and the Construction Manager will agree upon and assign percent complete values to activities in progress. In the event of a disagreement, the Owner, or its designated representative, shall make the final decision as to percent completion of each activity.
- C. After joint review, Construction Manager will process the Contractor's pay request based on progress from the Schedule.
 - 1. Payment to the Contractor shall be made from the progress reflected by the Interim or the Contract Schedule.

1.08 CONTRACT SCHEDULE PROVISIONS

- A. Time is of the Essence: Whenever it becomes apparent from the current monthly progress review that phases of Work or the Contract Completion Date will not be met, through no fault of the Owner, the Contractor will take the following actions with no change in the contract amount:
 - 1. Increase construction manpower to eliminate an adverse backlog of work.
 - 2. Increase the number of working hours per shift, shifts per day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the adverse backlog of work.
- B. The Contract Schedule, as updated and subject to review by the Owner, constitutes an integral part of the Contractor's performance under the Agreement.
- C. Should any activity fall fourteen (14) calendar days or more behind the Official Contract Schedule reviewed by the Owner, the Owner will have the right to order the Contractor to expedite completion of that activity using whatever means are appropriate and necessary, without additional compensation to the Contractor.
- D. Should any activity fall twenty (20) or more calendar days behind the Official Contract Schedule

reviewed by the Owner, through no fault of the Owner, the Owner will have the right to perform the activity or have the activity performed by whatever method the Owner deems appropriate. All costs incurred by the Owner in connection with expediting such activity under this subparagraph shall be reimbursed promptly to the Owner by the Contractor (see also General Conditions 'Owner').

- E. It is expressly understood and agreed that the failure by the Owner to either order the Contractor to expedite an activity or to expedite the activity by other means, pursuant to the two (2) preceding paragraphs, shall not be considered precedent setting with respect to any other activities which may fall behind the Official Contract Schedule approved by the Owner; nor will it relieve the Contractor from completion of the Project Work in accordance with the Official Contract Schedule and the Contract Completion Date.
- F. Owner's acceptance of, or its review of, comments about any schedule or scheduling data shall not relieve the Contractor from its sole responsibility to plan for, perform, and complete the Work within the Contract Time. Acceptance of or review of comments about any schedule shall not transfer responsibility for any schedule to Owner nor imply its agreement with; (1) any assumption upon which such schedule is based; or (2) any matter underlying or contained in such schedule.
- G. Failure of Owner to discover errors or omissions in schedules that it has reviewed, or to inform Contractor that Contractor, Subcontractors, or others are behind schedule, or to direct or enforce procedures for complying with the Contract Schedule, shall not relieve Contractor from its sole responsibility to perform and complete the Work within the Contract Time and shall not be a cause for an adjustment of the Contract Time or the Contract Sum.
- H. Schedule Revisions:
 - 1. General: Revisions to reviewed Construction Schedules must be approved in writing by the Owner and Construction Manager.
 - 2. Contractor: Submit requests for revision to schedule to the Owner together with written rationale for revisions and description of logic for rescheduling Work and maintaining Specific Contractual Milestone Dates listed in Contract Documents.
 - 3. Proposed revisions acceptable to Owner will be incorporated into next update of Construction Schedule.
- I. Acceptance: Acceptance of revised schedule by Owner does not relieve Contractor of meeting contractual milestone and completion dates.

1.09 RECOVERY SCHEDULE

- A. General: Should a progressed Construction Schedule show the Contractor to be fourteen (14) or more calendar days behind schedule at any time during construction, Contractor will prepare Recovery Schedule displayed on CPM schedule, at no additional costs to Owner. Prepare Recovery Schedule to show plan for returning to original schedule as expeditiously as possible.
- B. Schedule Preparation: Within three (3) days after notice from Owner, prepare and submit to Owner a Recovery Schedule, incorporating best available information from Subcontractors and others which will permit return to Construction Schedule at earliest possible time. Prepare Recovery Schedule to same level of detail as Construction Schedule and for maximum duration of one (1) month.
- C. Schedule Review: Within five (5) days after notice from Owner, participate in conference with Owner to review and evaluate Recovery Schedule. Submit revisions necessitated by review for Owner's approval within two (2) days of conference. Use approved Recovery Schedule for its planned duration as basis for return to Construction Schedule.
- D. Schedule Assessment: Five (5) days prior to expiration of Recovery Schedule, confer with Owner to assess effectiveness of Recovery Schedule. As a result of this conference, Owner will direct Contractor as follows:
 - 1. Behind Schedule: If Owner determines Contractor is still behind schedule, Owner will direct

Contractor to prepare another Recovery Schedule for subsequent pay period.

2. On Schedule: If Owner determines Contractor has successfully complied with provisions of Recovery Schedule, Owner will direct Contractor to return to use of Construction Schedule.

1.10 FLOAT TIME

- A. Float or slack time associated with one (1) chain of activities is defined as amount of time between earliest start date and latest start date or between earliest finish date and latest finish date for such activities, as depicted on Construction Schedule. Float or slack time is not for exclusive use or benefit of either Owner or Contractor. However, if float time associated with any chain of activities is expended but not exceeded by any actions attributable to Owner, Contractor will not be entitled to any extension in the Contract time.

1.11 SUBMITTALS

- A. Contractor's Construction Schedule: Submit one (1) electronic copy, three (3) printed copies, and one (1) reproducible of initial schedule large enough to show entire schedule for entire construction period.
- B. Construction Photographs: Submit prints in compliance with General Requirements Section - Photographic Documentation.
- C. Special Reports: Submit three (3) copies at time of unusual event.

1.12 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, submittals schedule, progress reports, payment requests, and other required schedules and reports.

PART 2 - PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Procedures: Comply with procedures contained in Associated General Contractors (AGC) "Construction Planning & Scheduling."
- B. Time Frame: Extend schedule from date established for Notice to Proceed to date of Notice of 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.
- C. Activities: Treat each tier or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
 1. Activity Duration: Define activities so no activity is longer than twenty (20) days, unless specifically allowed by Construction Manager.
 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than forty-five (45) 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 re-submittal times indicated in General Requirements Section - Submittal Procedures in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
- D. 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. 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. Use of premises restrictions
 - e. Environmental control
 2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards
 - b. Submittals
 - c. Purchases
 - d. Installation
 - e. Tests and inspections
 - f. Adjusting
 - g. Curing
 3. Area Separations: 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. New construction
 - b. Completion
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed and Notice of Completion.
- F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis (schedule fragnet) to demonstrate the effect of the proposed change on the overall project schedule.

2.02 INTERIM CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within twenty-one (21) days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first (1st) workday of each week with a continuous vertical line. Outline significant construction activities for first (1st) ninety (90) days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities

2.03 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 1. List of subcontractors and count of personnel at Project site
 2. List the CPM Schedule work activity number being performed for each subcontractor listed in Item 1 above as well as the work status, (e.g., S=Start, C=Continuing, F=Finished). At least weekly also include the approximate percent complete of those activities listed.
 3. Accidents
 4. Meetings and significant decisions

5. Unusual events (refer to special reports)
 6. Stoppages, delays, shortages, and losses
 7. Emergency procedures
 8. Orders and requests of authorities having jurisdiction
 9. Change Orders received and implemented
 10. Construction Change Directives received
 11. Services connected and disconnected
 12. Notice of Completions authorized
- 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.

2.04 SPECIAL REPORTS

- A. General: Submit special reports directly to Construction Manager within one (1) day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. 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 Construction Manager in advance when these events are known or predictable.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue updated schedule one (1) week before the last regularly scheduled progress meeting.
1. Include required CPM reports with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 2. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute one (1) copy on CD, and three (3) hard copies of updated schedule to the Construction Manager, and distribute to separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies of updated schedule 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 01 32 00]

SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY:

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:
 - 1. Bid breakdown of apparent low bidder (Instructions to Bidders)
 - 2. Contractor's Construction Schedule.
 - 3. Submittal Schedule.
 - 4. Shop Drawings.
 - 5. Fire Department Approvals
 - 6. All permits
 - 7. Product Data.
 - 8. Samples.
- B. Administrative Submittals: Refer to other Division -1 Sections and other Contract Documents sections for requirements for administrative submittals. Such submittals include, but are not limited to:
 - 1. Applications for payment.
 - 2. Performance and payment bonds.
 - 3. Insurance certificates.
 - 4. List of subcontractors.
 - 5. Construction Schedules.
 - 6. Schedule of Values.

1.03 SUBMITTAL PROCEDURES:

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction

activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
3. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

1.04 PROCESSING:

- A. Allow fourteen (14) calendar days for initial review time so that installation will not be delayed as a result of the time required to process submittals, including a one time (30) day time period for one time re-submittal process. The Architect will promptly advise the Contractor when a submittal being processed must be delayed for coordination
- B. No extension of Contract time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

1.05 SUBMITTAL PREPARATION:

- A. Place a permanent label for or title on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
- B. Provide a space to record the Contractor's and Architect's review and appropriate action markings and the action taken.
- C. Include the following information on the label for processing and recording action taken:
 1. Project name and address
 2. Date
 3. Name and address of Architect
 4. Name and address of Contractor
 5. Name and address of subcontractor
 6. Name of manufacturer
 7. Numbering System: Submittals shall be identified by specification section (i.e., 01-08 81 00-0, 01-09 30 00-0, 02-10 14 01-0 etc.) Any re-submittals shall be numbered sequentially according to the original submittal section, followed by the subscript submittal number -1, -2, -3 (i.e., 01-08 81 00 -1, 01-09 30 00 -1, 02-10 14 01 -1 etc.). Submittals and re-submittals shall be kept intact with the original number. Do not add new drawing or information outside the scope of the original submittal, unless specifically requested. Do not assign a new number for a re-submittal.
 8. Reference: List Specification Section number and product reference as a cross-reference for each submittal.

D. Identify each submittal with the following additional identification:

1. Contractor's stamp with initials or signature, certifying to review of submittal, compliance with Contract Documents, coordination with other impacted work, and verification of field measurements.
2. Drawing and Specification Section numbers to which the submittal applies.
3. Subcontractor's or supplier's name and address.
4. Name and telephone number of the individual to contact for additional information regarding the submittal.
5. Whether it is an original or a re-submittal.

E. SUMMARY:

1. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:
 - a. Submittal schedule
 - b. Submittal procedures
 - c. Daily construction reports
 - d. Shop Drawings
 - e. Product Data
 - f. Samples
 - g. Manufacturers' instructions
 - h. Manufacturers' certificates

F. Submittal Transmittal:

1. Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Construction Manager using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.

1.06 CONTRACTOR'S CONSTRUCTION SCHEDULE:

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule per section 01 32 00, Construction Progress Documentation. Submit schedule at pre-construction meeting.

1.07 SUBMITTAL SCHEDULE:

- A. Within thirty (30) calendar days after the Pre-construction Conference, Contractor shall provide a submittal schedule, procurement schedule and a list of submittal priorities in compliance with the General Conditions.

- B. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
- C. Prepare the schedule in chronological order. Provide the following information:
 - 1. Scheduled date for the first submittal
 - 2. Related Section number
 - 3. Event Number associated with CPM Construction Schedule
 - 4. Submittal category
 - 5. Name of subcontractor
 - 6. Description of the part of the Work covered
 - 7. Scheduled date for resubmittal
 - 8. Scheduled date the Architect's final release or approval
- D. Distribution: Following response to initial submittal, print and distribute five (5) copies to the Construction Manager. Submit other copies to subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
- E. When revisions are made, distribute 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 construction activities.
- F. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.
- G. Instruct recipients to report promptly any problems anticipated by dates or sequences shown in schedule.

1.08 SUBMITTALS PROCEDURES

- A. Coordinate preparation and processing submittals with performance of construction activities.
- B. Make submittals in groups containing associate items to ensure that information is available for checking each item when received.
- C. Partial submittals may be rejected as not complying with requirements of Contract Documents and Contractor shall be liable for any resulting delays.
- D. Place permanent label or title block on each submittal for identification. Indicate name of entity preparing each submittal in label or title block.
- E. Requests for deviation from Contract Documents must be submitted in accordance with the General Conditions.
- F. Contractor's Review:

1. Review submittals for accuracy, completeness, and conformity with Contract Documents.
 - a. Submittal shall be construed as stipulating Contractor has thoroughly and completely reviewed and coordinated data.
 - b. Submittals which indicate less than Contractor's full compliance will be returned without action.
 - c. Delays caused by failure to comply will not be acceptable basis for extension of Completion Time.
- G. Contractor shall certify that submittals have been reviewed and coordinated by adding the following affidavit to each submittal:

"This submittal has been reviewed and approved by (Name of Contractor) with respect to construction means, methods, techniques, sequences, safety aspect and other contractual obligations incidental to the submittal. The Contractor certifies that they have reviewed and approved not only the dimensions, but also that they have reviewed the submittal for the purpose of coordination with all other submittals as they relate directly or indirectly with the installation of this Work and have not relied solely upon the design documents in granting their approval. The Contractor additionally asserts that they have made all written notations concerning any information within the submittal that do not conform to the Contract Documents."

Signature _____ Date _____

Name Printed _____ Title _____

1. Submittals not certified by being stamped and signed by Contractor will be returned without action, as will submittals which, in the Construction Manager's or Architect's opinion, have not been adequately reviewed and coordinated by the Contractor.
- H. Package each submittal appropriately for transmittal and handling.
- I. Architect's Review:
 1. Submittals are reviewed for general conformance with design concept and general compliance with information given in Contract Documents only.
 2. Review of separate item shall not indicate acceptance of assembly of which item is part.
- J. Review shall not relieve Contractor from responsibility for errors or deviations from requirements of Contract Documents.
- K. Submittal Log: Maintain accurate submittal log for duration of Contract. Indicate current status of all submittals at all times. Make submittal log available for the Construction Manager's review upon request.
- L. Resubmittals: Subject to same terms and conditions as original submittal.
 1. Claims will not be considered for Contractor's additional time or expense associated with resubmittals.
 2. Architect will accept not more than one resubmittal. Should additional resubmittals be required,

Contractor shall reimburse Owner for Architects account for time spent in processing additional resubmittals at the current hourly rate.

M. Revisions: Make only those revisions required or accepted by Architect.

1.09 DAILY CONSTRUCTION REPORTS

A. Prepare daily construction reports to record manpower of the general contractor and each onsite subcontractor, a summary of progress, high and low temperature, precipitation, contract days expended, CPM activities performed and percent complete for each activity, and other pertinent information. Prepare one report for each workday. Submit the report of the previous day by 8:00 am the following workday.

1.10 SHOP DRAWINGS, PRODUCT DATA, SAMPLES, AND OTHER SUBMITTALS

A. General:

1. Submit only as required by the various Specification Sections. Do not submit shop drawings, product data, samples, or other submittals, unless specifically required.
2. Submit in accordance with the accepted submittal schedule. Send copies of transmittals to the Owner.
3. Submit in the manner and quantities specified hereinafter.
4. Allow a minimum of twenty (20) calendar days for processing by the Construction Manager, Architect, and his/her consultants, as applicable. Some submittals may require more processing time based upon consultant's input and the complexity of the submittal. If certain submittals are critical, they should be so identified at time of submission. If a specific submittal cannot be reviewed and returned within twenty (20) working days, the Architect will develop with the Construction Manager and Contractor a timely "turn-around" that will not impact the construction schedule.

1.11 SHOP DRAWINGS:

- A. Submit in reproducible PDF format to CM for review and distribution to A/E team.
- B. The Architect or his/her consultants, as applicable, will review the Shop Drawings; mark the reproducibles with required revisions; stamp the reproducibles and indicate "No Exceptions Taken", "Make Corrections Noted", "Submit Specified Item", "Revise and Resubmit", or "Rejected", and return the reproducibles. "Revise and Resubmit" or "Rejected" stamps shall not be construed by the Contractor as a valid reason for an extension of time.
- C. Review the returned reproducibles and take appropriate action as indicated.
1. If reproducibles are marked "Revise and Resubmit," make revisions and indicate them with a "cloud," stamp and date, and resubmit in the same manner and number as for the original submittal.
 2. If reproducibles are marked "Rejected," make a new submittal and submit in the same manner and number as for the original submittal.
 3. If reproducibles are marked "No Exceptions Taken" or "Make Corrections Noted", print and distribute copies for Owner and Inspector, as well as those required for Contractor and

Subcontractors.

4. As with the original submittal, review the returned reproducible and take appropriate action as indicated. As specified hereinabove, resubmit and revise until final action by the Architect or his/her consultants, or the Owner's consultants, as applicable. Final action is signified by the markings "No Exceptions Taken," or "Make Corrections Noted," on the returned reproducible.
- D. Following final action by the Architect or his/her consultants, or the Owner's consultants, as applicable, the Contractor shall make copies and distribute as required for accomplishment and inspection of the indicated Work.
- E. Only those Shop Drawings which bear stamps showing final review of the Contractor, Architect, or the Architect's consultants, or the Owner's consultants, as applicable, shall be used.
- F. Reproduction and Mailing Costs: The Contractor shall pay the reproduction and mailing costs of the reproducible and all prints.
- G. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
- H. Preparation of coordination Drawings is specified in Section 01 31 13 - Project Coordination- and may include components previously shown in detail on Shop Drawings or Product Data.
- I. Submit coordination Drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.
- J. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
- K. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:
 - L. Dimensions.
 - M. Identification of products and materials included.
 - N. Compliance with specified standards.
 - O. Notation of coordination requirements.
 - P. Notation of dimensions established by field measurement.
- Q. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets 30" x 42".
- R. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

1.12 PRODUCT DATA:

- A. Submit quantities as required by the General Conditions and/or individual Specification Sections.
- B. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
- C. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
 - 1. Manufacturer's printed recommendations.
 - 2. Compliance with recognized trade association standards.
 - 3. Compliance with recognized testing agency standards.
 - 4. Application of testing agency labels and seals.
 - 5. Notation of dimensions verified by field measurement.
 - 6. Notation of coordination requirements.
- D. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
- E. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
- F. Do not proceed with installation until an applicable copy of Product Data is in the installer's possession.
- G. Do not permit use of unmarked copies of Product Data in connection with construction.

1.13 SAMPLES:

- A. Submit in the size specified in the individual Specification Sections, and in the quantity required to be returned to the Contractor, together with three (3) additional Samples, which will be retained by the Architect or his/her consultants, or the Owner's consultants, as applicable.
- B. Ship samples to the Construction Manager's office, carriage prepaid. Samples to be returned to the Contractor will be shipped, carriage collect.
- C. Submit samples to illustrate functional and aesthetic characteristics of Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- D. Preliminary Submittals:
 - 1. Unless precise color, pattern, and texture or similar characteristic are specifically described, submit full set of choices for material or product.

2. Preliminary submittals will be reviewed and returned with Architect's mark indicating selection and other action.
3. Architect reserves right not to make individual determination or selections until all samples of all materials are submitted.
4. Submit samples of all selected colors, patterns, textures, or other similar characteristics as selected by Architect.
5. Submit number of samples required by Contractor plus three (3), which will be retained.
 - a. Where variation in color, pattern, texture or other characteristics are inherent in material or product, submit multiple units (not less than three (3), that show approximate limits of variations.
 - b. Accepted samples will form standard of comparison for finished Work.
 - c. Defects, and deviations in excess of those in accepted samples, are unacceptable and are subject to rejection of completed Work.
6. Include identification on each sample, with full Project information, including:
 - a. Project name and location
 - b. Manufacturer and supplier
 - c. Name, finish, and composition of material
 - d. Location where material is to be used
 - e. Specification Section number
7. Reviewed samples which may be used in the Work are indicated in individual specification sections.
8. Field Samples: Provide field samples as required by individual sections. Install samples in locations as directed, completed, and finished.
9. Submit samples finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers and materials, color range sets, and swatches showing color, texture, and pattern.
10. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
11. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
12. Unless noncompliance with Contract Documents provisions is observed, the submittal may serve as the final submittal.

13. Other Submittals: Submit as specified in the individual Specification Sections.

1.14 ARCHITECT'S ACTION:

- A. General: Review by the Architect shall not be construed as a complete check, but only that the general method of construction and detailing is satisfactory. Review shall not relieve the Contractor from responsibility for errors which may exist.
- B. Final Unrestricted Release: Where submittals are marked "No Exceptions Taken," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final.
- C. Final-But-Restricted Release: When submittals are marked "Make Corrections Noted" that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittals and requirements of the Contract Documents; final acceptance will depend upon that compliance.
- D. Returned for Resubmittal: When the submittal is marked "Revise and Resubmit" or "Rejected," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations and resubmit without delay. Repeat process, if necessary, to obtain a different action mark.
 - 1. Do not permit submittals marked "Revise and Resubmit" or "Rejected" to be used at the Project Site, or elsewhere where Work is in progress.
- E. Revisions: Make all revisions required by the Architect. If the Contractor considers any required revision to be a change, he/she shall so notify the Architect as provided for under "Changes" in the General Conditions. Show each drawing revision by number, date and subject in a revision block on the drawing. Make only those revisions directed or approved by the Architect.
- F. Revisions after approval: When a submittal has been reviewed by the Architect, resubmittal for substitution of materials or equipment will not be considered unless by an acceptable explanation as to why the substitution is necessary.

1.15 PATTERNS AND COLORS

- A. Unless the exact pattern and color of a product are indicated in the Contract Documents, whenever a choice of pattern or color is available for a product, submit accurate color charts and pattern charts to the Architect for his/her review and selection.

1.16 CERTIFICATES OF COMPLIANCE

- A. Submit certificates of compliance with the associated Shop Drawings, Product Data, Samples, and other submittals required for the product.
- B. Submit on 8-1/2" x 11" white paper.
- C. Submit three copies.

1.17 SUBSTITUTION:

- A. Approval required. Reference General Conditions, 'Substitution of Materials', Article GC-45.

1.18 "OR EQUAL":

- A. Where the phrase "or equal" or "or equal as approved by the Architect" occurs in the Contract Documents, do not assume that materials or equipment will be approved as equal unless the item has been specifically approved for this work by the Architect per the General Conditions – Article GC-45 "Substitution of Materials".
- B. The decision of the Architect shall be final.

1.19 DEFERRED SUBMITTALS

- A. Submit samples to illustrate functional and aesthetic characteristics of Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Jurisdictional Approval Required: All deferred submittals must receive a formal "Job Site" approval stamp from the Madera County Building Department (AHJ) prior to the commencement of associated fabrication or installation.
- C. Submission Timeline:
 - 1. Initial Submission to Architect/EOR: No later than thirty (30) calendar days after the Notice to Proceed (NTP).
 - 2. Architect/EOR Review Period: Allow fourteen (14) calendar days for the Architect and Engineer of Record to review.
 - 3. Resubmittal Requirement: If a deferred submittal is returned as "Rejected" or "Revise and Resubmit," the Contractor shall have seven (7) calendar days to address all comments and return the revised package to the Architect.
 - 4. Clean Approval Requirement: Submittals marked "Make Corrections Noted" or "Approved as Noted" are not acceptable for deferred items. The Contractor must incorporate all notes and obtain a final, clean "Approved" or "No Exceptions Taken" stamp from the Architect/EOR before the package is eligible for submission to the AHJ.
 - 5. Submission to AHJ: Within three (3) business days of receiving a clean approval from the Architect, the Contractor shall submit the package to the Madera County Building Department for formal review.
- D. Responsibility for Delay: The Contractor is responsible for the professional coordination of all deferred systems. Any delays resulting from late submissions, the failure to provide a clean resubmittal within seven (7) days, or the failure to obtain AHJ approval prior to scheduled installation shall be considered Contractor-caused delays.
- E. Schedule of Deferred Submittals:
 - 1. Fire Sprinkler System
 - 2. Fire Alarm System

PART 2 - PRODUCTS (not used).

PART 3 - EXECUTION (not used).

END OF SECTION 01 33 00

SECTION 013600

ELECTRONIC DRAWING FILES

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This section describes the limitations of use of any electronic files furnished to the Contractor.

1.02 DRAWING FILES

- A. Drawing files are the original work of the professional Architect and his consultants who retain all ownership rights. As such, they may not be used or reproduced beyond the limits hereinafter described without the expressed written permission of the Architect.
- B. The Architect has no contractual obligation to provide electronic files, however such files may be furnished for the convenience of the Contractor to use in the preparation of shop drawings or to coordinate the work of different trades. Architect may withhold permission to use any or all, electronic files at the sole discretion of the Architect.
- C. Electronic drawing files to be made available to the Contractor shall be limited to background plan type information. Detail drawings and similar files will not be furnished electronically.
- D. At the request of the Contractor, the Architect will furnish a single copy of electronic files to the Contractor in a recent AutoCAD version on appropriate media.
1. The general contractor shall make a single request for files and indicate all files desired for all trades. Requests received from subcontractors will be directed to the General Contractor or ignored.
 2. Contractor shall be responsible for converting files to other formats and for making and distributing copies to subcontractors.
 3. The Architect shall be entitled to reasonable reimbursement from the Contractor for time and materials expended to reproduce more than one copy of the files, or if the Contractor requests additional files not included in the original request.
- E. The Architect and his consultants make no warrantee as to the accuracy, reliability or usefulness of electronic files or information. Contractor use of files shall result in assumption of all risks associated with their use.
- F. Limitations of use:
1. Contractor shall not use or rely upon electronic files as contractual documents. Contractor shall independently field verify and measure all as-built and field conditions and shall not rely upon electronic files for determining clearances and dimensions, for preparing material take-offs, or other critical elements of work.
 2. Contractor shall transfer files to his own title block drawing sheets. Contractor shall not use or print any title blocks, logos or other marks that identify or imply authorship of the Architect or his consultants on any documents created or used by the Contractor. Such use is a violation of the Business and Professions Code and is subject to fines and other legal consequences. Documents produced by the Contractor that contain such

information shall be immediately destroyed.

3. Contractor may use electronic files to prepare shop drawings or to coordinate the work of different trades. Any use of electronic files in a manner that simply reproduces the electronic files for submittal as shop drawings will be rejected without review.

END OF SECTION

SECTION 01 41 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY:

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements of the Contract Documents and all applicable governing codes. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-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 quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Owner, Construction Manager, Architect, or authorities that have jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
 - 1. Division 1 Section 01 32 00 - "Construction Progress Documentation" for developing a schedule of required tests and inspections.
 - 2. Division 1 Section 01 73 29 - "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
 - 3. Divisions 2 through 40 Sections for specific test and inspection requirements.

1.03 DEFINITIONS:

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by authorized representatives of the Owner.
- C. Testing Laboratory: An independent Testing Laboratory employed by the Owner.

- D. Project Representative: Construction Manager as defined in General Conditions.

1.04 QUALITY ASSURANCE:

- A. 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.
- B. 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.
- C. 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.
- D. 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.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction 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 products that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

1.05 QUALIFICATIONS

- A. Testing Laboratory Qualifications: A Testing Laboratory with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed. All samples shall be taken by and tests performed by certified testers employed by the Testing Laboratory.

1.06 LIMITATIONS OF SERVICES

- A. The tests and controls set forth are intended only to be a checklist from which the Construction Manager may select those that are applicable to the specific project.
- B. The Testing Laboratory shall make only those tests and provide only such controls that are set forth in the pertinent Sections of the Specifications and such others as will be specifically designated by the Construction Manager and those otherwise required by building codes and other regulations. Also, the Testing Laboratory shall consult the Construction Manager regarding the extent or limit of such tests and controls, within each category, not inconsistent with such building codes and other regulations.

- C. The Testing Laboratory is not authorized to release, revoke, alter, or enlarge on requirements of the Contract Documents, nor to approve or accept any portion of the work nor to perform any duties of the Contractor.
- F. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

1.07 CONTRACTOR'S RESPONSIBILITIES

- A. Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
- B. Contractor shall cooperate with the Testing Laboratory in providing samples and information for facilitating all of the tests and controls set forth herein, or those selected herefrom by the Construction Manager.
- C. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
- D. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
- E. The Contractor shall cooperate with agencies performing required inspections, tests and similar service and provide reasonable auxiliary services, samples and information for facilitating all of the tests and controls set forth herein. Auxiliary services required include but are not limited to:
 - 1. Providing ready access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - 2. Make materials required for testing available to the Testing Laboratory and assist in acquiring these materials. Taking adequate quantities of representative samples of materials that require testing or assisting the Testing Laboratory in taking samples, in ample time to allow for Laboratory testing. Do not use materials requiring testing until they have been tested and written approval has been received from the Testing Laboratory.
 - 3. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 - 4. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
 - 5. Security and protection of samples and test equipment at the Project Site.
- F. Arrange for the timely presence and recommendations of the Testing Laboratory representative for the Contractor's field or shop operations such as soils compaction, welding procedures, and similar critical operations, at the start of such operations.
- G. If work, which is required to be tested or inspected, is covered up without prior notice or approval, such work, shall be uncovered at the discretion of the Construction Manager.

- H. Items proposed by the Contractor as substitutions to those specified may require testing, when deemed necessary by the Construction Manager and Architect, to establish equality with the items specified.
 - 1. The Testing Laboratory for making such tests will be selected by the Construction Manager.
 - 2. Costs of tests and preparation of samples shall be borne by the Contractor when such tests are authorized by him/her.
 - 3. Special preparation of sample for testing, if required, shall be done at the source of supply under the direction of the Testing Laboratory.
 - 4. Deliver test specimens to the Testing Laboratory in ample time to avoid job delays.
 - 5. Specimens shall bear similar approvals, labels, and identifications as those for the specified item.
 - 6. At the option of the Construction Manager, the Contractor shall furnish certificates of compliance, at no cost to the Owner, from suppliers or manufacturers in lieu of performing tests.
 - 7. The Construction Manager will designate the items in this category.
- I. Unless otherwise directed, materials not conforming to the requirements of the Contract Documents shall be promptly removed from the job site.

1.08 LABORATORY'S DUTIES

- A. Perform specified sampling and testing of materials.
 - 1. Comply with specified standards.
 - 2. Ascertain compliance of materials with requirements of the Contract.
- B. Promptly notify Construction Manager, Architect, Construction Inspector, and Contractor of observed irregularities and deficiencies in the Work and in products to be used in the Work.
- C. After each inspection and test promptly submit one copy of certified written laboratory report to the following:
 - 1. Owner.
 - 2. General Contractor.
 - 3. Inspector.
 - 4. Architect.
 - 5. Construction Manager.
 - 6. Structural Engineer (Related tests and inspections)
 - 7. Mechanical, Plumbing and Electrical Engineers (Related tests and inspections).
- D. Each report shall include:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Testing Laboratory name, address, and telephone number.
 - 4. Name and signature of laboratory inspector.
 - 5. Date and time of sampling and testing.
 - 6. Record of temperature and weather conditions.
 - 7. Date of test.
 - 8. Identification of product and specification section.
 - 9. Location of sample or test in the project.

10. Type of test.
 11. Results of tests and compliance with the Contract.
 12. Interpretation of test results when requested by the Construction Manager.
 13. Signed by a Registered Civil Engineer licensed in the State of California.
- E. Submit a final report of special test and inspections at Notice of Completion, which includes a list of unresolved deficiencies.
- F. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- G. Retesting required because of nonconformance to the specified requirements shall be performed by the same Testing Laboratory.
- H. Arrange with the Construction Manager for the delivery of samples of items requiring testing, in ample time to allow for analysis and testing.
- I. Arrange for the timely presence and recommendations of a Testing Laboratory representative for the Contractor's field or shop operations such as soils compaction, welding procedures, and similar critical operations, at the start of such operations.
- J. Promptly notify Architect, Construction Manager, and Contractor of irregularities or deficiencies in the Work observed during performance of Testing Laboratory's services. Immediately upon Testing Laboratory determination of a test failure, the Laboratory will telephone the results to the Construction Manager and Contractor. On the same day, Laboratory will send written test results to those named on above distribution list.
- K. Laboratory shall be licensed to conduct testing and inspection operations in California.

PART 2 - PRODUCTS (not used)

PART 3 – EXECUTION

3.01 TEST SELECTION

- A. The Contractor shall be responsible for, and shall pay for, all off-site and on-site tests except for the following:
1. Earthwork: Field and Laboratory tests of soil used for fill and earth backfill as placed and compacted. Inspect placing of fill and backfill and determine conformance to compaction requirements.
 2. Aggregate base and asphalt paving.
 3. Reinforcing for concrete and masonry.
 4. Concrete quality control.
 5. Masonry mortar and grout.
 6. Full time masonry inspection.
 7. Welding inspections and tests.

8. Structural steel.
 9. Expansion anchor pull-out.
 10. Deck Welding.
 11. Spray applied fireproofing.
- B. The Contractor shall notify the Construction Manager in writing (3) three working days in advance of time for the above-named tests.

3.02 REPAIR AND PROTECTION:

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
 2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- 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 01 41 00

SECTION 01 43 39

MOCK-UPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY

- A. Mock-Up requirements are intended to establish general configuration and scope.
- B. When Mock-Up is required, perform no installation or application until Mock-Up is reviewed.
- C. Submit schedule for Mock-Up construction. Show date and relationship to reviewed Construction Schedule.
- D. Construct Mock-Up for review by Construction Manager, Owner, and Architect for compliance to requirements of the Contract Documents, approval of color, texture, finish quality and detail.
- E. Construct Mock-Ups on site, except as otherwise specified, at location indicated or otherwise approved by Construction Manager.
- F. Construct Mock-Ups required by individual Specification Sections.
- G. Assemble and erect Mock-Ups as scheduled at the end of this Section.
- H. Modify or replace Mock-Up until Mock-Up is accepted.
- I. Approved Mock-Up:
 - 1. Shall remain until the remainder of the work of the Section requiring Mock-Up is complete.
 - 2. Will be used as the standard of acceptable quality for the remainder of the Project.
 - 3. May be incorporated into the work at the discretion of the Construction Manager, except as otherwise noted.
 - 4. Shall be removed at the completion of the work of that Section when required by Section or when not incorporated into the work.

1.03 SUBMITTALS

- A. Mock-Up Review Report
 - 1. Submit report indicating status of compliance of reviewed Mock-Up with requirements of Contract Documents.
 - 2. Indicate all deviations from requirements of Contract Documents. If there are no deviations, indicate that Mock-Up is in complete compliance.

3. Failure to indicate Mock-Up deviations may result in withdrawal of acceptance.
4. Change Order, based on report, will be issued to include allowed deviations.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide all required fastenings, bracings and supports.
- B. Erect plumb and true to lines and levels, firmly erected and anchored to adjacent materials and substrate.
- C. Install components under provisions of applicable Sections.
- D. Notify Construction Manager upon completion of Mock-Up construction and make arrangements for review.
- E. Modify the Mock-Up and construct new components as required by Construction Manager to secure acceptance.

3.02 CLEAN-UP

- A. Remove Mock-Ups specified to be removed or not incorporated into the work when directed by Construction Manager. Clear area after Mock-Up has been removed.

END OF SECTION 01 43 39

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY:

- A. This Section specifies requirements for temporary facilities and controls, including utility, construction and support facilities, and security and protection. Furnish and install all required temporary facilities and controls as shown or specified herein plus such facilities as required for proper performance of the Contract. All such temporary facilities and controls shall be located where directed and re-located as required by the progress of the work and maintained in a safe and sanitary condition at all times until completion of the Contract.
- B. Contractor shall be responsible for all of its own office and construction utilities including the cost of permits, usage, generation, installation, relocation, distribution, metering, maintenance, safety, disposal, and removal. Coordinate this work with the Construction Manager.
- C. Coordinate installation and removal of temporary utilities with Construction Manager, utility companies, other contractors, and authorities having jurisdiction. Contractor shall submit plans to the Construction Manager for approval of proposed temporary utilities and facilities.
- D. Do not install or remove any temporary utility without prior written approval by Construction Manager. Construction Manager's written approval does not guarantee or warrant that utilities installed by the Contractor will not require relocation in the future due to the follow-on and/or sequence of work by Contractor or other contractors or by changes in scope and sequence of work by the Owner.
- E. Temporary utilities placed underground shall be permanently marked as to prevent damage by others, and accurately located for removal. Damage to above ground and underground utilities by the Contractor or others shall be repaired or replaced by the Contractor at no cost to the Owner.
- F. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution
 - 2. Electric power service
 - 3. Lighting
 - 4. Telephone service
 - 5. Internet Service
- G. Support facilities include, but are not limited to, the following:
 - 1. Project identification and temporary signs

2. Waste disposal facilities
 3. Temporary heat and ventilation
 4. Field offices and storage boxes
 5. Sanitary facilities, including drinking water
 6. Temporary enclosures, fencing and barricades
 7. Construction aids and miscellaneous services and facilities
 8. Storm water control and drainage
- H. Security of the buildings shall be maintained at all times. Security and protection facilities include, but are not limited to, the following:
1. Environmental protection
 2. Security enclosure and lockup
 3. Temporary fire protection
 4. Barricades, warning signs, lights
 5. Shoring and scaffolding
- I. Removal of Temporary Facilities
- Remove temporary facilities and controls, including associated materials and equipment, when their use is no longer required.
- Restore and recondition areas of the site damaged and disturbed by temporary facilities and controls and their installation.
3. Remove and properly dispose of debris resulting from removal and reconditioning operations.
- J. Submittals
- Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.
2. Implementation and Termination Schedules: Submit a schedule indicating implementation of each temporary utility within 15 days of the date established for commencement of the Work.

1.03 USE CHARGES:

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner, Construction Manager or Architect and shall be included in the Contract Sum. Contractor shall be responsible for his/her own temporary power and for coordination with Pacific Gas and Electric Company (PG&E) for that temporary power service. Multiple temporary power services to the site may be required due

to availability of power. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. Owner's Representatives
2. Inspection and/or Testing agencies
3. Personnel of authorities having jurisdiction

1.04 QUALITY ASSURANCE:

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:

1. Building Code requirements
2. Health and safety regulations
3. Utility company regulations
4. Police, Fire Department and Rescue Squad rules
5. Environmental protection regulations.

B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70 and applicable codes.
3. Refer to Guidelines for Bid conditions for Temporary Job Utilities and services prepared jointly by AGC and ASC for industry recommendations.

C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.05 PROJECT CONDITIONS:

A. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat
2. Relocate temporary services and facilities as required by progress of the Work
3. Operate in a safe and effective manner
4. Take necessary fire prevention measures
5. Do not overload facilities, or permit them to interfere with progress

6. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the Site.
7. Allow free use and access of all utilities at all times to all entities contracted to perform the Work.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by the Construction Manager. Provide materials suitable for use intended. Provide specified utility services required during construction and extend temporary service lines to construction areas to allow use by all trades, and subcontractors.
- B. Paint: Comply with requirements in Section 09 91 00 "Painting".
 1. For sign panels and applying graphics, provide exterior grade alkyd glass enamel over exterior primer.
- C. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame spread rating of fifteen (15) or less. For temporary enclosures provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- D. Water: Provide potable water approved by local health authorities.
- E. For fences and vision barriers, provide exterior type, minimum 3/8" thick plywood.
 1. For safety barriers, sidewalk bridges and similar uses provide minimum 5/8" thick exterior plywood.

2.02 EQUIPMENT:

- A. General: Provide equipment and materials suitable for use intended.
- B. Field Offices: Provide mobile units with lockable entrances, operable windows, serviceable finishes, heated, air conditioned and on foundations adequate for normal loading. Comply with all applicable codes and requirements.
- C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- D. Temporary Toilet Units: Provide a sufficient number of self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. Units shall be accompanied by hand washing stations, including paper towels and covered trash receptacles in accordance with governing regulations.
- E. Drinking-Water Fixtures: Containerized, bottled-water drinking-water units, including paper cup supply.

1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7.2 to 12.7 deg C).
- F. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- G. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.
- H. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress.
- I. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where fixtures are exposed to breakage. Provide exterior fixtures were exposed to moisture.
- J. Trash removal: The Contractor shall be responsible for providing trash receptacles. He/she shall be responsible for the removal of debris from the job site and shall keep all work areas and passageways in and around the project free from debris. Collect waste from construction areas daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above eighty (80) deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner. Owner trash facilities may not be used. If, in the Construction Manager's opinion, the contractor has not performed due diligence in keeping the site clean on a weekly basis, monies will be withheld from the contractor's monthly progress payment in the maximum amount of \$1,000.00 per weekly occurrence. This notification will come from the Construction Manager in writing. These accumulated monies will be released to the contractor in the contractor's next pay application upon verification by the Construction Manager that the site has been cleaned.
- K. First Aid Supplies: Comply with governing regulations.
- L. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses one hundred feet long (100'), with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL:

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION:

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials, and equipment. Comply with utility company recommendations.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
 4. Arrange with electric utility service company to provide service for power and lighting for temporary field offices. Pay costs for service and power used.
 5. Distribute electric power and lighting.
 6. Provide lighting and convenience outlets in the temporary structures, and as otherwise required for the performance of the Work.
 7. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Construction Manager, change over from use of temporary service to use of the permanent service.
 8. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
- B. Water Service: Existing well to be demolished at the North East portion of the site is available in its existing condition for Contractor's use for temporary construction water, prior to demolishing. Contractor shall be responsible for all work and associated costs to make the well operable.
1. Contractor may connect to existing water point of connection for their use. Contractor is responsible for flushing and sterilizing new and existing piping prior to connection. Owner is not responsible for any damage to Contractor's system or equipment due to inadequate flushing or sterilization of existing piping.
 2. Provide water for construction purposes.
 3. Install branch piping with taps located so that water for demolition, grub, clear, compaction, and construction purposes is available throughout the Work by the use of hoses. Protect piping and fitting against freezing.
 4. Make potable water available for human consumption.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
1. Locate as approved by the Construction Manager.

2. Provide containers to remove and dispose of effluent off the site in a lawful manner.
- D. Electric Power Service: Contractor may tap into site electrical service at the existing Building 2 main electrical room. Contractor must install power meter for monitoring construction power.
- E. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment in quantity, size and type acceptable for each phase of the Work.
- F. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities.
 1. Provide one telephone and one facsimile machine (FAX) in each Contractor's field office and pay costs for installation, maintenance, service, and removal.

3.03 SUPPORT FACILITIES INSTALLATION:

- A. General: Comply with the following:
 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities as directed by the Construction Manager.
 2. Provide noncombustible construction for offices, shops, and sheds located within thirty (30) feet of building lines. Comply with NFPA 241.
 3. Maintain support facilities until Completion as necessary. Remove upon completion of the Contractor's final contract milestone and written approval by the Construction Manager. Personnel remaining after Notice of Completion may be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Heat and Ventilation: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy. Provide forced ventilation of enclosed areas for proper installation and curing of materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors and gases. Pay the costs of installation, maintenance, operation, and removal of temporary heat and ventilation, including costs for fuel consumed, required for the performance of the Work.
- C. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within the designated building site.
- D. Toilets: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. Units shall be accompanied by hand washing stations, including paper towels and covered trash receptacles in accordance with governing regulations.
 1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.

E. Drinking Water Fixtures: Provide drinking water as required by OSHA, including paper supply.

- F. Temporary Enclosures: Provide temporary enclosures for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
 - 1. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of twenty-five (25) square feet or less with plywood or similar materials.
 - 2. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with venting and material drying and curing requirements to avoid dangerous conditions and effects
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section 2.09 C.4 "Housekeeping" and Article 3.05 of this section for progress cleaning requirements.
 - 1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
 - 2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION:

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until requested by the Construction Manager.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities, including but not limited to, water truck or water storage tank, fire hoses, nozzles and fire extinguishers. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher for every seventy-five (75') of travel.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 - 4. Provide fire extinguisher access and supervision welding operations and similar sources of fire ignition.
 - 5. Provide water truck or other means to provide temporary fire protection until such time as permanent fire protection is in service.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into

operation and use. Instruct key personnel on use of facilities.

- D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for the erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public, of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- E. Environmental Protection:
 - 1. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result.
 - 2. Avoid use of tools and equipment which produce harmful noise.
 - 3. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons in or near the site.
 - 4. Erosion and Sediment Control: Prepare and implement a comprehensive erosion and sediment control program. Perform daily cleanup of mud and dust carried onto street surfaces by construction vehicles. Throughout excavation, haul trucks shall use tarpaulins or other effective covers. Upon completion, use effective measures to reduce wind erosion. Perform replanting and repaving operations as soon as practicable after site grading.
 - 5. Air Quality / Dust Control:
 - a. Indoor Operations: Control dust resulting from indoor construction operations by localizing it to greatest possible extent using temporary partitions, curtains, or other means which will prevent spread of dust beyond immediate work area. Duct openings and other openings communicating with other parts of building shall have effective temporary closures.
 - b. Outdoor operations: Provide dust control as required to abate any dust nuisance on or adjacent to Project Site. Apply water by means of approved sprinkling equipment, water wagons, or spray from hoses, to extent and amount required at any time that dust control is necessary, as determined by the City or Construction Manager. Use of chemicals, oil or other such materials will not be permitted.
- F. Provide and maintain suitable temporary barriers as required to prevent public entry; protect the work and existing facilities, persons, and trees and plants from damage or injury from construction operations.
- G. Preserve and protect existing trees, irrigation, all landscaping, and plants not designated or required to be removed, and those adjacent to the site. As required, provide barriers to a minimum height of 6'-0" around each tree and plant, or around groups in proximity of construction operations.

3.05 CLEANING DURING CONSTRUCTION:

- A. Contractor shall dispose of all material off-site, in a lawful manner. Do not allow the accumulation of scraps debris, waste material and other items not required for construction of this work. Remove waste materials and rubbish not less than on a weekly basis and dispose of at Contractor's expense.

- B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.
- C. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.
- D. Each sub-contractor shall clean up the results of his/her work and deliver such debris to areas designated for holding by Prime Contractor.
- E. Weekly, and more often if necessary, sweep all interior spaces clean. "Clean", for the purpose of this sub-paragraph, shall be interpreted as meaning free from dust and other materials capable of being removed by reasonable diligence using a hand-held broom.
- F. Following the installation of finish floor materials, clean the finish floor and provide adequate protection. Inspect protection daily (or more often if necessary) while work is being performed in the space in which finish materials have been installed. "Clean", for the purpose of this sub-paragraph, shall be interpreted as meaning free from all foreign materials which, in the opinion of the Construction Manager or Architect, may be injurious to the finish floor material.

3.06 OPERATION, TERMINATION AND REMOVAL:

- A. Maintenance: Maintain facilities in good operating condition until removal. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a twenty-four (24) hour/day basis where required to achieve indicated results and to avoid the possibility of damage.
- B. Termination and Removal: Unless the Construction Manager requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by the authorized use of a permanent facility, or no later than the Final Billing. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the 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 the Contractor. The Owner reserves the right to take possession of the Project identification signs.
 - 2. Prior to Notice of Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
 - a. Replace air filters and clean the inside of ductwork and housings.
 - b. Replace significantly worn parts and parts that have been subject to unusual operating conditions as determined by the Construction Manager.
 - c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

3.07 TREE AND PLANT PROTECTION

- A. Preserve and protect existing trees, plants and grapevines which are not designated or required to be removed, and those adjacent to the site.
- B. Consult with the Construction Manager prior to removal of roots and branches which interfere with

demolition and construction operations. Remove only those items agreed upon in writing with the Construction Manager.

- C. Provide barriers to a minimum height of 6' around each tree and plant, around each group of trees and plants, as applicable, in the proximity of demolition and construction operations.
- D. In the proximity of root zones of trees and plants:
 - 1. Prohibit vehicular traffic and parking.
 - 2. Prohibit storage of materials and equipment.
 - 3. Prevent dumping of refuse and chemically injurious materials and liquids.
 - 4. Prevent puddling and continuous running water.
- E. Carefully supervise excavating, grading, and filling, and subsequent construction operations, to prevent damage.
- F. At no increase in Contract Sum, replace, or suitably restore trees and plants designated to remain which are damaged or destroyed as a result of demolition and construction operations.
- G. Remove and lawfully dispose of soil that has been contaminated during the performance of the Work by oil, solvents, and other materials which could be harmful to trees and plants, and replace with good soil, at no increase in Contract Sum. Provide manifests for removed soil to Construction Manager.

3.08 SECURITY

- A. Secure, maintain, and protect the Work, stored materials, equipment, and temporary facilities until time of Final Completion, or such earlier time as Owner may choose to assume such responsibility.
- B. Security and protection may be by any legal method, or combination of methods, acceptable by the Construction Manager.

3.09 TEMPORARY CONTROLS

- A. Noise and Vibration:
 - 1. Equipment and impact tools shall have intake and exhaust mufflers.
 - 2. Secure written permission from the Construction Manager at least three (3) working days prior to using noisy and vibratory equipment, such as jackhammers, concrete saws, impact tools, and high-frequency electrical equipment.
 - 3. Cooperate with the Owner and/or Construction Manager if the use of noisy and vibratory equipment becomes objectionable by its longevity.
- B. Dust and Dirt:
 - 1. Conduct demolition and construction operations to minimize the generation of dust and dirt, and prevent dust and dirt from interfering with the progress of the Work and from accumulating in Work and adjacent areas.

2. To additionally minimize the generation of dust and dirt, hauling equipment and trucks carrying loads of soil and debris shall have their loads sprayed with water or covered with tarpaulins.
 3. Prevent dust and dirt from accumulating on walks, roadways, parking areas, and planting, and from washing into sewer and storm drain lines.
 4. Periodically water exterior demolition and construction areas to minimize the generation of dust and dirt.
- C. Water: Do not permit surface and subsurface water and other liquids to accumulate in or about the Project site and vicinity thereof. Should such conditions develop, control the water or other liquid, and suitably dispose of it by means of temporary pumps, piping, drainage lines, troughs, ditches, dams, or other methods.
- D. Pollution:
1. No burning of refuse, debris, or other materials shall be permitted on or in the vicinity of the Project site.
 2. Comply with applicable regulatory requirements and anti-pollution ordinances during the conduct of construction and disposal operations.
- E. Pest Control: Take necessary provisions to control rodents, insects, and other pests.

3.10 PROJECT IDENTIFICATION AND SIGNS

- A. General:
1. Contractor shall have provisions in their contract to provide a 4'-0" x 8'-0" project identification sign with graphics and verbiage given to them by the Construction Manager. No other language or graphics will be permitted the sign other than what is approved by the Construction Manager. Contractor shall construct and maintain, at the contractors cost, this identification sign throughout the entire course of the project. Location of the sign will be provided by the Construction Manager.
 2. Signs other than the specified Project sign will not be permitted, unless otherwise approved in advance by the Construction Manager. No Contractor signs or banners are allowed on the temporary fence.

3.11 SITE CONTROLS AND PARKING

- A. Entrance to Work Site: Contractor and his/her employees shall use certain access roads or entrances as indicated on attached drawing or as directed by Construction Manager. Maintain these roads in satisfactory condition during Contract time, and repair damages attributable to Work of this Project at intervals as needed. At completion of Contract, roads and entrances shall be left in condition at least equal to that existing at start of Contract, except as may be otherwise required by Contract Documents.
- B. Site Storage and Work Areas: Construction Manager will allocate available on-site storage and work areas to Contractor, subject to change as may be necessary by job progress such as site development or other intervening Work.

- C. Regulations: Observe and comply with rules and regulations in effect at occupied facilities, including, but not restricted to, parking and traffic regulations, security restrictions, hours of access, etc.
- D. Use of Public Sidewalks and Streets: Make arrangements with local authorities including Traffic Engineer, for temporary use of streets and sidewalks for offices, shops, storage, etc. Abide by County rules, regulations, and ordinances. Obtain permits and pay all required fees.

END OF SECTION 01 50 00

SECTION 01 55 00

TRAFFIC REGULATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY

- A. This section describes procedures for traffic regulation during construction in public streets and highways.

1.03 STANDARD SPECIFICATIONS

- A. Wherever reference is made to the State Specifications and Plans, such reference shall mean the State of California, Business and Transportation Agency, Department of Transportation Agency, Department of Transportation Standard Specification and Plans, 2006 edition for English units.

1.04 SUBMITTALS

- A. The Contractor shall submit a traffic control plan prior to start of construction operations, prepared, signed, and sealed by a California licensed civil or traffic engineer to the Construction Manager for review and approval. Preparation of any additional traffic control plans or detail that may be required by other agencies during the course of the work shall be the Contractor's responsibility.

1.05 GENERAL

- A. Provide safe and continuous passage for pedestrian and vehicular traffic at all times.
- B. Control traffic at those locations indicated and in conformance with the approved traffic control plans and specifications.
- C. Furnish, construct, maintain, and remove detours, road closures, traffic signal equipment, lights, signs, barricades, fences, K-rails, flares, solar-powered flashing arrow signs, miscellaneous traffic devices, flagmen, drainage facilities, paving, and such other items and services as are necessary to adequately safeguard the public from hazard and inconvenience. All such work shall comply with the ordinances, directives, and regulations of authorities with jurisdiction over the public roads in which the construction takes place and over which detoured traffic is routed by the Contractor. After devices have been installed, the Contractor shall, at his/her own expense, maintain and keep them in good repair and working order until no longer required. The Contractor shall also pay the cost of replacing such devices that are lost or damaged, to such an extent as to require replacement, regardless of the cause of such loss or damage.
- D. Prior to the start of construction operations, notify the City of Madera and County of Madera giving the expected starting date, completion date, and the names and telephone numbers of two responsible persons who may be contacted at any hour in the event of a condition requiring immediate emergency service to remove, install, relocate, and maintain warning devices. In the event these persons do not promptly respond, or the authority deems it necessary to call out other forces to accomplish emergency service, the Contractor will be held responsible for the cost of such emergency service.

- E. The Contractor shall obtain and pay all fees for Permit(s) required by City of Madera or County of Madera pertaining to traffic regulation.

1.06 TRAFFIC CONTROL DEVICES AND SIGNS

- A. Traffic control devices and temporary striping shall conform to the State Standards Plans and Specifications. Construction signs shall conform to the latest edition of the State of California Sign Specification Sheets.
- B. The placement of construction signing, striping, barricades, and other traffic control devices used for handling traffic and public convenience shall conform to the latest edition of the State of California, Department of Transportation, "Manual of Traffic Controls for Construction and Maintenance Work Zones" and the Caltrans Manual Section 5 2006 (revision 1) edition.
- C. Signs shall be illuminated or reflectorized when they are used during hours of darkness. Cones and portable delineators used for night lane closures shall have reflective sleeves. Barricades used in the diversion of traffic shall be equipped with flashers if they are in place during hours of darkness.
- D. During the duration of a detour, cover all existing signs not in accordance with the traffic control plan. Existing signs which are in force shall be relocated to provide visibility from all relocated traffic lanes.

1.07 VEHICULAR TRAFFIC CONTROL

- A. Accomplish construction in phases by detouring traffic from its normal patterns. Restore traffic to normal patterns in each phase before proceeding to the next phase. Traffic control plan shall be approved by City of Madera.
- B. Transition traffic lane transitions from permanent lanes to construction zone patterns in accordance with the requirements for the normal posted speed limit and as shown in the drawings.
- C. Unless otherwise shown in the drawings or allowed by Madera County, limit construction activities to 7a.m. to 5 p.m. Monday through Friday. Return roadways and sidewalks to unrestricted vehicle and pedestrian usage when construction is not underway.

1.08 ACCESS TO ADJACENT PROPERTIES

- A. Maintain reasonable access from public streets to adjacent properties at all times during construction. Prior to restricting normal access from public streets to adjacent properties, notify each property owner or reasonable person, informing him of the nature of the access restriction, the approximate duration of the restriction, and the best alternate access route for that particular property.

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION (not used)

END OF SECTION 01 55 00

SECTION 015700

SPECIAL PROJECT PROCEDURES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY

- A. The following Special Project Procedures shall be developed, enacted, and maintained throughout the course of construction by the Contractor. These requirements are in addition to those specified within the Contract General Conditions, and include: Environmental Protection Plan, Smoke / Odor Control, Noise Control, Dust and Air Pollution Control, Welding and Burning, Erosion Control, Storm Water, Disposal Operations, Cultural Resources.

1.03 ENVIRONMENTAL PROTECTION PLAN

- A. The area of work shall be kept in an organized and clean condition to protect both the on-site and off-site environment during the progression of the Work.
- B. Contractor shall develop an Environmental Protection Plan and submit for the Construction Manager's review within 30-days from the Notice to Proceed. The approved Plan shall be implemented and distributed to the employees of the Contractor, as well as the Contractor's subcontractors, suppliers, and materialmen. The Environmental Protection Plan shall include, but not be limited to, the following items:
 - 1. Copies of required permits.
 - 2. Proposed sanitary landfill site.
 - 3. Other proposed disposal sites.
 - 4. Noise control.
 - 5. Dust control.
 - 6. Erosion control.
 - 7. State General Construction Activity Storm Water Permit (Contractor shall obtain permit and administer all requirements).
- C. The Contractor shall be solely responsible for all construction operations undertaken to complete the project. Any construction operation or activity shall comply with all federal, state, and local requirements pertaining to water, air, solid waste and noise pollution.
- D. For the purpose of this Plan the following definitions apply:
 - 1. Sediment: Soil, sand, silt, clay, and/or other debris that have been eroded and transported by runoff water.
 - 2. Solid Waste: Any solid matter such as refuse, wood residues, sand, rubbish, debris, garbage, and other discarded solid materials resulting from construction activities, maintenance and/or repair work. Solid waste also includes organic matter such as leaves, and tree trimmings.
 - 3. Chemical Waste: Includes any petroleum-based products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, disinfectants, organic chemicals, and inorganic wastes. Some of these wastes may be classified as "hazardous" materials.
 - 4. Sanitary Wastes
 - a. Sewage: Domestic sanitary sewage.
 - b. Garbage: Refuse and scraps resulting from food preparation, including cooking, dispensing, and consumption of food.
 - 5. Hazardous Materials: Should the Contractor detect site materials that are believed to be asbestos, polychlorinated biphenyl (PCB), or other such hazardous material, the Contractor shall stop the work in the proximate area and immediately notify the Construction Manager in

writing. Work in the affected area shall not be resumed pending an investigation to determine if the questionable material is indeed hazardous resulting in one of the following accommodations: 1) the material has been abated; 2) the material has been identified as non-hazardous, or 3) the material has been rendered harmless.

E. Protection of natural resources

1. General: It is intended of the Contract Documents that the natural resources scheduled to remain within the project boundaries and outside the limits of permanent work performed under this contract be preserved in their existing condition or be restored to an equivalent condition upon completion of the Work. The Work shall be confined to the work area limits shown on the drawings. Upon completion of the work return adjacent surfaces disturbed and not altered by the work defined by the Contract Documents to their pre-construction elevations and general appearance.
2. Land Resources: Do not remove, cut deface, injure or destroy trees, shrubs, or landscape areas outside the work area limits. Do not remove, deface injure or destroy trees within the work area scheduled to remain without written permission from the Construction Manager. Should damage to existing landscape occur the Contractor at its expense shall remove and/or replace the damaged landscape at the sole discretion of the Owner.
3. Water Resources: The Contractor shall investigate and comply with all applicable federal, state, and local regulations concerning the discharge, whether directly or indirectly of pollutants to underground and natural waters. At all times, special measures shall be taken to prevent oily or other hazardous substances from entering the ground, drainage areas or local bodies of water in such quantities as to affect normal use, aesthetics or produce a measurable impact upon the area. Any soil or water that is contaminated with oily substances due to the Contractor's operations shall be disposed of in accordance with applicable regulations at the Contractor's expense. Perform all work under this Contract in such a manner that any adverse environmental impacts are reduced to a level that is acceptable to the applicable regulatory agency(s).

1.04 SMOKE / ODOR CONTROL

- A. Primary fresh air intakes to existing adjacent buildings must be protected from exhaust gases from internal combustion engines, paint and solvent fumes, and any other noxious fumes and vapors. Protection of adjacent building fresh air intakes must be accomplished in a manner that will not interfere with the functionality of the air intake systems.
- B. The Contractor must implement control methods such as snorkels or other mechanical means from engines exhausts to a minimum of 50 feet away from adjacent building air intakes.
- C. Any other fume generating activities must be limited to a minimum distance of 50 feet away from any adjacent building air intake grille.
- D. In the event that fume generating activities must occur within 50 feet of an adjacent building air intake the Contractor will be required to complete the work as follows:
 1. Notify the Construction Manager in writing at least 14 days in advance of the scheduled work.
 2. Complete the work when it least impacts Owner activities, (i.e., evenings, weekends, or favorable wind conditions); or,
 3. Provide filter media, plastic barriers, or other control methods to assure that only fresh air enters the adjacent building ventilation system.

1.05 NOISE CONTROL

- A. Maximum noise levels within 500 feet of any business or adjacent building area shall not exceed 90 dBA at a distance of 50 feet as measured under the noisiest operation conditions for equipment components such as trenchers, pavers, graders, and trucks. The maximum noise level for all other equipment shall not exceed 85 dBA at 50 feet under the same conditions.

- B. Jackhammers shall be equipped with exhaust mufflers and steel muffling sleeves when noise levels exceed the above limits. Air compressors should be of a quiet type such as a "whisperized" compressor, and all compressor hoods shall be closed while the equipment is in operation. If necessary, provide portable noise barriers constructed of ¾-inch plywood lined with 1-inch-thick fiberglass on the work side around jackhammering activities.
- C. Keep noisy equipment as far as possible from noise-sensitive site boundaries. Machines should not be left idling. The Contractor is encouraged to use electric power in lieu of internal combustion engine powered tools and equipment wherever possible.
- E. The Contractor shall schedule noisy operations so as to minimize their duration at any given location, and to minimize disruption to the adjoining business and building occupants. Notify the Construction Manager in advance of performing work creating unusual noise and schedule such work at times mutually agreeable to the Owner and Construction Manager.
- F. Operation of musical equipment such as radios, DVD players, tape players, television, and other similar items at the construction site is forbidden.

1.06 DUST AND AIR POLLUTION CONTROL

Enlist measures to avoid the creation of dust and air pollution.

- A. Dust and Dirt Control: Comply with following Mitigation Measures from the San Joaquin Valley Air Pollution Control District (SJVAPCD) CEQA Guidance Document "Guide for Assessing and Mitigating Air Quality Impacts" (GAMAQI) Table 6-2:
 - 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, covered with a tarp or other suitable cover or vegetative ground cover.

At a minimum unpaved area shall be wetted a minimum of three times a day or as frequently as necessary to eliminate dust formation. When wind velocity exceeds 15 mph the site shall be watered as frequently as necessary to eliminate dust migration.
 - 2. All land clearing, grubbing, scraping, excavation, land leveling, grading, cut & fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking.
 - 3. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each workday. (The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions.) (Use of blower devices is expressly forbidden.)
 - 4. 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.
 - 5. Trucks hauling soil, sand, debris, garbage, or other similar loose materials to and from the site shall be covered.
 - 6. Trackout shall be immediately removed when it extends 50 or more feet from the site and sweep area streets adjacent to the project as necessary, but no less than once per workday to eliminate as much as practicable the tracking of dirt and debris offsite.
- B. Air Pollution Control
 - 1. All volatile liquids, including fuels and solvents shall be stored in closed containers.

2. Debris, refuse, lumber, and/or other scrap material burning is forbidden.
 3. Properly maintain equipment to reduce gaseous pollutant emissions.
 - B. Cover stockpiles of soil, debris, sand or other similar loose materials to prevent migration.
 - C.
- 1.07 WELDING AND BURNING
- A. Eliminate welding and burning of steel as much as possible. Where unavoidable, perform welding and burning with all possible precaution to avoid fire hazards. Provide a fire watch for a minimum of 45 minutes after burning stops. Provide protection for all adjacent materials and /or surfaces.
- 1.08 STORM WATER / EROSION CONTROL
- A. Contractor shall obtain a State General Construction Activity Storm Water Permit and shall administer all requirements, including, but not limited to the development and implementation of the Storm Water Pollution Prevention Plan (SWPPP) and Best Management Practices (BMP) for the project.
- 1.09 DISPOSAL OPERATIONS
- A. Solid Waste Management: Supply solid waste transfer containers at various site locations as necessary to keep the site free of construction debris and garbage. Debris such as spent air filters, oil cartridges, cans, bottles, combustibles, and litter shall be placed in appropriate containers and routinely removed from the jobsite. The Contractor shall take measures to prevent trash and papers from blowing onto adjacent property.
 - B. Washing of concrete trucks/containers where wastewater may reach adjacent property, storm drains or natural watercourses will not be permitted. Remove any excess concrete to the sanitary landfill.
 - C. Chemical Waste and Hazardous Materials: Furnish containers for storage of spent chemicals used during construction operations. Dispose of chemicals and hazardous materials in accordance with applicable regulations.
 - D. Garbage: Store garbage in covered containers and dispose of contents to a lawful sanitary landfill at routine intervals or as necessary to prevent the accumulation of on-site trash.
 - E. Dispose of vegetation, weeds, rubble, and other materials removed during demolition, clearing, and stripping operations to a suitable off site disposal site in accordance with applicable regulations.
 - F. Excavated Materials: Remove from the site any spoil material that is in excess of that required for backfill and such excavated material unsuitable for backfill. Excess backfill material shall be hauled off site and no additional compensation will be paid to the Contractor for such off haul. Unsuitable excavated material shall be disposed of off site in accordance with applicable regulations to a site identified in the Environmental Plan immediately following excavation.
- 1.10 PROTECTION OF CULTURAL RESOURCES
- A. Protection of Cultural Resources:
 1. In the event any historic surface or subsurface archaeological features or deposits, including locally darkened soil ("midden"), that could conceal cultural deposits, animal bone, shell, obsidian, mortars, or human remains, are uncovered during construction, work within 100 feet of the find shall cease and a qualified archaeologist shall be contacted by the County to determine if the resource is significant. If the find is determined to be of significance, resources (such as grinding stones and mano fragments) shall be donated to an appropriate cultural center.

2. When Native American archaeological, ethnographic, or spiritual resources are involved, all identification and treatment shall be conducted by qualified archaeologists who are either certified by the Society of Professional Archaeologists (SOPA) or meet the federal standards as stated in the Code of Federal Regulations (36 CFR 61), and Native American representatives who are approved by the local Native American community as scholars of their cultural traditions.

In the event that no such Native American is available, persons who represent tribal governments and/or organizations in the locale in which resources could be affected shall be consulted. When historic archaeological sites or historic architectural features are involved, all identification and treatment is to be carried out by historical archaeologists or architectural historians. These individuals shall meet either SOPA or 36 CFR 61 requirements.

3. If human bone or bone of unknown origin is found during construction, all work shall stop in the vicinity of the find and the County Coroner shall be contacted immediately. If the remains are determined to be Native American, the Coroner shall notify the Native American Heritage Commission who shall notify the person it believes to be the most likely descendent. The most likely descendent shall work with the contractor to develop a program for reinterment of the human remains and any associated artifacts. No additional work is to take place within the immediate vicinity of the find until the identified appropriate actions have been carried out.
4. The Owner may retain an Archaeologist to monitor and/or recover data and artifacts during the construction work.
5. All items found or recovered considered to have archaeological significance are the property of the Owner.

END OF SECTION

SECTION 01 61 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. The Contractor's Construction Schedule is included in Section 01 32 00, "Construction Progress Documentation"; and the Schedule of Submittals is included under Section 01 33 00, "Submittals."
- C. Administrative procedures for handling requests for substitutions are included under Section 01 25 00, "Substitutions."

1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
 - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - 2. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
 - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.04 DESCRIPTION

- A. Material and equipment incorporated in the Work shall be:
 - 1. New, unless otherwise specified.
 - 2. In a condition acceptable to the Owner and the Architect.
 - 3. Suitable for the use intended.
 - 4. In conformance with EPA codes and regulations and applicable air quality control district.
- B. No material or equipment shall be used for any purpose other than that for which it is designed or specified.

- C. No material shall contain asbestos.
- D. No materials or products shall contain formaldehyde in excess of the amount recommended by the State of California Department of Health Services (DOHS).

1.05 TRANSPORTATION AND HANDLING

- A. Deliver manufactured products in the manufacturer's original, unbroken containers or packaging, with identifying labels intact and legible.
- B. Immediately on delivery, inspect shipments to assure compliance with the requirements of the Contract Documents and reviewed submittals, and to verify that products are properly protected and undamaged.
- C. Handle products in a manner to avoid soiling and damaging the products and their packaging.
- D. Promptly remove damaged and defective products from the site and replace at no increase in Contract Sum.

1.06 STORAGE

- A. Store manufactured products in accordance with the manufacturers' printed instructions, with seals and labels intact and legible.
 - 1. Store products subject to damage by the elements in weathertight enclosures.
 - 2. Maintain temperature and humidity within the ranges specified by the manufacturers.
- B. Exterior Storage:
 - 1. Store fabricated products above the ground, on blocking or skids, to prevent soiling and staining.
 - 2. Cover products which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
 - 3. Store loose granular material in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- C. Arrange storage to facilitate inspection.
- D. Periodically inspect stored products to assure that products are maintained under specified conditions and free from damage and deterioration.
- E. Protection After Installation:
 - 1. Provide substantial coverings as necessary to protect installed products from damage from traffic and construction operations. Remove coverings when no longer needed.
 - 2. Maintain temperature and humidity conditions for interior equipment and finish products in accordance with the manufacturers' printed instructions.

1.07 PRODUCT OPTIONS

- A. For products indicated or specified only by reference standard, select any product meeting such standard.

- B. For products indicated or specified by naming several products or manufacturers, select any one (1) of the products or manufacturers named which complies with the specified requirements.
- C. For products indicated or specified by naming only one (1) product and manufacturer, there is no option.
- D. Products not meeting the criteria hereinabove, shall be considered Substitutions, and shall be submitted as specified under Section 01 25 00 "Substitutions".
- E. "Or accepted equal" means a product accepted in writing by the Architect prior to bid opening for use in the Work as being equivalent in essential attributes to the product indicated or specified in the Contract Documents. Reference Section 01 25 00 "Substitutions".

1.08 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Each Contractor is responsible for providing products and construction methods compatible with products and construction methods of other Contractors.
- D. If a dispute arises between Contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
- E. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which 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 after installation, on an accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

1.09 OWNER-FURNISHED, CONTRACTOR-INSTALLED (OFICI) PRODUCTS

- A. Risk of Loss: The Contractor's responsibility for OFCI products commences upon the Contractor's written acceptance of the delivery from the Owner's carrier. From that point until the Notice of Completion, the Contractor assumes full risk of loss or damage.
- B. Receiving and Inspection:

1. Contractor shall provide at least five (5) business days' notice to the Construction Manager and Owner prior to the required delivery date of OFCI items.
 2. Contractor shall provide labor and equipment to unload OFCI products at the project site.
 3. Joint Inspection: Contractor, Construction Manager, and Owner shall jointly inspect shipments for damage and completeness. Contractor shall document any discrepancies or damage on the bill of lading and notify the Owner in writing within 24 hours.
- C. Storage and Protection:
1. Contractor shall store and protect OFCI products in accordance with the requirements of Articles 1.05 and 1.06 of this Section.
 2. Costs for providing climate-controlled storage for OFCI items, if required by the manufacturer, shall be included in the Contract Sum.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are new and undamaged and unused at the time of installation.
1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience.
1. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
 - a. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "Substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.
 2. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.
- C. Owner-Furnished Products:
1. Products furnished by the Owner are identified in Section 01 11 00, "Summary of Work."
 2. Contractor's receipt of OFCI products does not relieve the Contractor of the duty to provide all auxiliary materials, fasteners, and accessories necessary for a complete and functional installation as required by Paragraph 2.01.A.1.

PART 3 EXECUTION

3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
 - 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Notice of Completion.

END OF SECTION

SECTION 016500

STARTING OF SYSTEMS

PART 1 – GENERAL

1.1 Section Includes

- A. Starting systems.
- B. Demonstration and instructions.
- C. Testing, adjusting, and balancing.

1.2 Related Sections

- A. Quality Control: Manufacturers field reports.
- B. Contract Closeout.

1.3 Starting Systems

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Construction Manager seven (7) days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence or other conditions that may cause damage.
- D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specifications sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report in accordance with Quality Requirements that equipment or system has been properly installed and is functioning correctly.

1.4 Demonstration and Instructions

- A. Demonstrate operation and maintenance of Products to Owner personnel minimally two weeks prior to date of Substantial Completion.
- B. Demonstrate Project equipment and instruct in a classroom environment located at the site and instructed by a qualified representative who is knowledgeable about the Project.
- C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner personnel in detail, to explain all aspects of operation and maintenance.
- D. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance,

and shutdown of each item of equipment at scheduled times, at designated location.

- E. All demonstrations and training sessions of equipment/products/systems by qualified personnel shall be videotaped or recorded on DVD by the Contractor. Two copies of the videotape or DVD shall be provided to the Owner.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used

END OF SECTION

SECTION 01 70 00**EXECUTION AND CLOSEOUT REQUIREMENTS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Closeout submittals.
 - 2. Examination and preparation.
 - 3. Installation.
 - 4. Closeout procedures.
 - 5. Warranties.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 01 74 23 - Final Cleaning: For administrative and procedural requirements for final cleaning at Substantial Completion.

1.02 REFERENCES

- A. CALGreen - California Green Building Standards, 2022 Edition
- B. NFPA - National Fire Protection Association
 - 1. 70 - National Electrical Code.

1.03 SYSTEM DESCRIPTION

- A. The Operation and Maintenance Manual for the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.4, Section 5.410, Article 5.410.4.5.

1.04 CLOSEOUT SUBMITTALS

- A. Record Drawings: Maintain 1 hard copy and 1 digital set of Contract Drawings as Record Drawings. Mark to show installation that varies from the Work originally shown.
- B. Record Specifications: Maintain 1 hard copy and 1 digital set of the Project Manual, including addenda, as Record Specifications. Mark to show variations in the Work performed in comparison with the text of the Specifications and modifications.
- C. Operation and Maintenance Data: Organize hard copy data into 3-ring binders, with pocket folders for folded sheet information. Mark identification on front and spine of each binder. Also provide 1 digital set of information for all operation and maintenance data. Include the following:
 - 1. Emergency instructions.
 - 2. Spare parts list.
 - 3. Copies of warranties.
 - 4. Wiring diagrams.
 - 5. Shop Drawings and Product Data.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION**3.01 EXAMINATION AND PREPARATION**

- A. Examine substrates and conditions for compliance with manufacturer's written requirements including, but not limited to, surfaces that are sound, level, and plumb; substrates within installation tolerances; surfaces that are smooth, clean, and free of deleterious substances; and application conditions within environmental limits. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 1. Existing Utilities and Equipment: 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.
- B. Prepare substrates and adjoining surfaces according to manufacturer's written instructions, including, but not limited to, the application of fillers and primers.

3.02 INSTALLATION

- A. Comply with manufacturer's written instructions for installation. Anchor each product securely in place, accurately located and aligned. Clean exposed surfaces and protect from damage. If applicable, prepare surfaces for field finishing.
- B. Comply with NFPA 70 for installation of electrically operated equipment and electrical components and materials.

3.03 CLOSEOUT PROCEDURES

- A. Request Substantial Completion inspection once the following are complete:
 - 1. Advise the Owner of pending insurance changeover requirements.
 - 2. Submit Record Drawings and Specifications, maintenance manuals, warranties and similar record information.
 - 3. Deliver spare parts, extra stock and similar items.
 - 4. Changeover locks and transmit keys to the Owner.
 - 5. Complete startup testing of systems and instruction of operation and maintenance personnel.
 - 6. Remove temporary facilities and controls.
 - 7. Complete final cleanup.
 - 8. Touch up, repair and restore marred, exposed finishes.
 - 9. Obtain final inspections from authorities having jurisdiction.
 - 10. Obtain certificate of occupancy.
- B. Upon receipt of a request for inspection, the Architect and Owner will proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion after inspection or advise the Contractor of items that must be completed or corrected before the certificate will be issued.
- C. Arrange for each installer of equipment that requires operation and maintenance to provide instruction to the Owner's personnel. Include a detailed review of the following:
 - 1. Startup and shutdown.
 - 2. Emergency operations and safety procedures.
 - 3. Noise and vibration adjustments.
 - 4. Maintenance manuals.
 - 5. Spare parts, tools, and materials.
 - 6. Lubricants and fuels.
 - 7. Identification systems.

8. Control sequences.
 9. Hazards.
 10. Warranties and bonds.
- D. Request inspection for certification of final acceptance and final payment, once the following are complete:
1. Submit final payment request with releases of liens and supporting documentation. Include insurance certificates.
 2. Submit a copy of the Substantial Completion inspection list stating that each item has been completed or otherwise resolved for acceptance.
 3. Submit final meter readings for utilities, a record of stored fuel, and similar data as of the date of Substantial Completion.
 4. Submit consent of surety to final payment.
- E. The Architect will reinspect the Work on receipt of notice that the Work has been completed.
1. On completion of reinspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of the Work that is incomplete or obligations that have not yet been fulfilled.

3.04 WARRANTIES

- A. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions 02 through 49.
- B. 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, nor does it relieve suppliers, manufacturers and subcontractors required to countersign special warranties with the Contractor.
- C. The following form shall be used for this Project:
1. The General Conditions, Article 2.24, cover the Contractor's responsibility to remedy defects due to faulty workmanship and materials which appear within 1 year from the date of final Project acceptance.
 2. Guarantees for more than 1 year, where indicated in various Sections of the Specifications, shall be in the form of a guarantee written on the letterhead of the Contractor, subcontractor or supplier doing the work and/or supplying the item to be guaranteed as follows:

Guarantee

for _____ (item) _____

We hereby guarantee that the _____ (item) _____, which has been installed in North Fork Branch Library, 32908 Road 222, North Fork, CA 93643, for the Owner, has been done in accordance with the Drawings and Specifications, and that the work as installed, will fulfill the requirements of the guarantee included in the Specifications. We agree to repair or replace any or all of our work, together with any other adjacent work which may be displaced by so doing, that may prove to be defective in its workmanship or materials within a period of ____ years from the date of Substantial Completion of the above named structure, without any expenses whatsoever to the Owner; ordinary wear and tear and unusual abuse or neglect excepted.

In the event of our failure to comply with the above mentioned conditions within a reasonable time but in no event longer than 30 days after being notified in writing by the Owner, we, collectively or separately, do hereby authorize the agents of the Owner to proceed to have said defects repaired and made good at our expense, and we will honor and pay the costs and the charges therefor upon demand.

Signed

SUBCONTRACTOR/SUPPLIER

LICENSE NO. _____

Countersigned

CONTRACTOR

LICENSE NO. _____

END OF SECTION

SECTION 01 71 23

FIELD ENGINEERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 DESCRIPTION

- A. Layout and install the Work to the lines and grades indicated and specified.
- B. Retain and pay expenses of a qualified engineer or land surveyor to establish on the site the required reference points and benchmarks, establish building lines and elevations, check structural steel framework for plumbness, and establish on steel frame the required basic grid lines from which Work of other sections shall be laid out.

1.03 QUALIFICATIONS OF ENGINEER OR SURVEYOR

- A. The engineer or land surveyor shall be licensed in the State of California and shall be acceptable to the Owner.

1.04 SURVEY REFERENCE POINTS

- A. Existing basic horizontal and vertical control points for the project are indicated.
- B. Locate and protect control points prior to starting site Work and preserve permanent reference points during construction.
 - 1. Make no changes or relocations without prior authorization from the Construction Manager.
 - 2. Report to the Construction Manager if a reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.
 - 3. Require land surveyor to replace control points which become lost or destroyed, base replacements on original survey control.

1.05 PROJECT SURVEY REQUIREMENTS

- A. Establish lines and levels; locate and layout:
 - 1. Site Improvements:
 - a. Stakes for grading, fill and topsoil placement.
 - b. Utility slopes and invert elevations.
 - 2. Batter boards for structures.
 - 3. Building foundations, column locations.

4. Controlling lines and levels required for mechanical and electrical work.

B. From time to time verify layouts to ensure accuracy.

1.05 RECORDS

A. Maintain a complete, accurate log of control and survey Work as it progresses.

1.06 SUBMITTALS

A. Submit name and address of civil engineer and land surveyor.

B. Upon request, submit documentation to verify accuracy of field engineering Work.

C. Submit record documents under provisions of Section 01 77 19.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 01 71 23

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY:

This Section specifies administrative and procedural requirements for cutting and patching.

- . Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work. See also S0"
- C. Divisions 2 through 40 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 22 through Division 28 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.03 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after Installation of other Work.

1.04 SUBMITTALS:

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
- B. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
- C. Describe anticipated results in terms of changes to in-place construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
- D. List products to be used and firms or entities that will perform work.
- E. Indicate dates when cutting and patching is to be performed.
- F. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

- G. Construction Managers approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.
- H. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations signed and sealed by a structural engineer licensed to practice in the State of California to show how reinforcement is integrated with the original structure.
- I. Review of the Contractor's submittal by the Engineer to proceed with cutting and patching does not waive the Engineer's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.05 QUALITY ASSURANCE:

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
- B. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
 - 1. Foundation construction.
 - 2. Bearing Walls
 - 3. Structural concrete.
 - 4. Equipment supports.
 - 5. Piping, duct work, vessels and equipment.
 - 6. Structural steel
 - 7. Structural wood
 - 8. Lintels
 - 9. Structural Decking
 - 10. Misc structural metals
 - 11. Operational and Safety Limitations: Do not cut and patch operational elements or safety related components in a manner that would result in reducing their safety to perform as intended, or result in increased maintenance, or decreased operational life or safety.
- C. Obtain approval of cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
 - 1. Primary operational systems and equipment.
 - 2. Control systems.
 - 3. Communication systems.

4. Electrical wiring systems.
 5. Operational systems of special construction in Division 13 Sections.
- D. Miscellaneous Elements: Do not cut and patch the following elements or related 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.
1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Piping, ductwork, vessels, and equipment.
 6. Noise- and vibration-control elements and systems
- E. Visual Requirements: Do not cut and patch work exposed on the exterior or in occupied spaces, in a manner that would, in the County's Construction Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.
1. If possible, retain original installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized experienced, and specialized firm. Contractor will be responsible to warranty all work.
 - a. Processed concrete finishes.
 - b. Stonework and stone masonry.
 - c. Ornamental metal.
 - d. Matched-veneer woodwork.
 - e. Preformed metal panels.
 - f. Roofing.
 - g. Firestopping.
 - h. Window wall system.
 - i. Stucco and ornamental plaster.
 - j. Terrazzo.
 - k. Finished wood flooring.
 - l. Fluid-applied flooring.
 - m. HVAC enclosures, cabinets, or covers.

1.06 WARRANTY

- A. General Warranty: The Contractor shall warrant all cutting and patching work against defects in materials and workmanship for a period of one (1) year from the date of Substantial Completion.
- B. Performance Guarantee: The Contractor shall guarantee that all patched areas meet the following standards for the duration of the warranty period:
1. Visual Integrity: Patched surfaces shall remain free of visible cracks, blisters, or peeling. Finished surfaces must maintain a seamless match to adjacent undisturbed surfaces in color, texture, and plane.

2. Structural Integrity: Patches in structural elements (slabs, shear walls, foundations, etc.) shall show no signs of settling, shifting, or separation from the original substrate.
 3. Weather-tightness: Any patching performed on the building enclosure (roofing, siding, waterproofing, or flashings) shall remain 100% weather-tight and leak-free.
 4. System Continuity: Patches in fire-rated assemblies, acoustic barriers, or vapor membranes shall maintain the certified rating and continuity of the original system.
- C. Corrective Work: Upon written notification of a failure in a patched area, the Contractor shall, at no additional cost to the Owner, perform necessary repairs to restore the area to the standard of the original Contract Documents. All corrective work, including the restoration of affected finishes, must be completed within fourteen (14) calendar days of notification.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and action before proceeding, if unsafe or unsatisfactory conditions are encountered.
- B. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION:

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- C. Take all precautions necessary to avoid cutting existing pipe, conduit or duct work serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them

3.03 PERFORMANCE:

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete work without delay.
 1. Cut existing construction to provide for installation of other components or performance of

other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine that is appropriate for the work to be done.
4. Comply with requirements of applicable Sections of Division 31 where cutting and patching requires excavating and backfilling.
5. By-pass utility services such as pipe and conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap valve or plug and seal the remaining portion of pipe and conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
6. Patch with durable seams that are as invisible as possible. Comply with tolerances.
7. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
8. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction to break of plane in a manner that will eliminate evidence of patching and refinishing.
9. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance. Replace wall coverings to break of plane if required for match.
10. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing patch, after patched area has received prime and base coat.
11. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
12. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition.

3.04 CLEANING:

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit, and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 01 74 00

CLEANING DURING CONSTRUCTION & FINAL CLEANING

1.01 GENERAL

- A. This section includes cleaning during construction and final cleaning on completion of the work.
- B. At all times maintain areas covered by the Contract and adjacent properties and public access roads free from accumulations of waste, debris, and rubbish caused by construction operations.
- C. Conduct cleaning and disposal operations to comply with local ordinances and antipollution laws. Do not burn or bury rubbish or waste materials on project site. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains. Do not dispose of wastes into streams or waterways.
- D. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

1.02 CLEANING DURING CONSTRUCTION

- A. During execution of work, clean site, adjacent properties, and public access roads and dispose of waste materials, debris, and rubbish to assure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
- B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
- C. Provide containers for collection and disposal of waste materials, debris, and rubbish.
- D. Cover or wet excavated material leaving and arriving at the site to prevent blowing dust. Clean the public access roads to the site of any material falling from the haul trucks.

1.03 SITE CLEANING PRIOR TO LANDSCAPING

Remove concrete, concrete wash, stucco splatter, gunite overspray, and all other wastes and debris prior to final grading and landscaping.

1.04 FINAL CLEANING

- A. At the completion of work and immediately prior to final inspection, clean the entire project site as follows.
- B. Clean, sweep, wash, and polish all work and equipment including finishes.
- C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces, polish surfaces.
- D. Repair, patch, and touch up marred surfaces to match adjacent surfaces.
- E. Broom clean paved surfaces; rake clean landscaped areas.
- F. Remove from the site all temporary structures and all materials, equipment, and appurtenances not required as a part of, or appurtenant to, the completed work.

END OF SECTION

SECTION 01 74 19**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Construction waste management.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 02 41 19.13 - Selective Building Demolition: For selective demolition of building elements.

1.02 REFERENCES

- A. CALGreen - California Green Building Standards, 2022 Edition

1.03 SYSTEM DESCRIPTION

- A. The Construction Waste Management Plan for the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.4, Section 5.408, Articles 5.408.1, 5.408.2, 5.408.2.1, and 5.408.3.

1.04 WASTE MANAGEMENT GOALS FOR THE PROJECT

- A. The Owner has established that this Project shall minimize the creation of construction and demolition waste on the of job site. Factors that contribute to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, and contamination, shall be minimized. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.
- B. Diversion Goals: A minimum 65 percent of total Project waste shall be diverted from landfill. The following waste categories, at a minimum, shall be diverted from landfill:
 - 1. Clean dimensional wood, pallet wood.
 - 2. Bricks.
 - 3. Concrete masonry units (CMU).
 - 4. Cardboard.
 - 5. Metals.
 - 6. Gypsum board (unpainted).
 - 7. Paint.
 - 8. Carpet and pad.
 - 9. Beverage containers.
 - 10. Insulation.

1.05 SUBMITTALS

- A. Waste Reduction Calculations: Before request for Substantial Completion, submit 3 copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

- B. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- C. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- D. 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.

1.06 WASTE MANAGEMENT PLAN

- A. Waste Management Plan: Within 10 calendar days after receipt of Notice of Award of Bid, or prior to any waste removal, whichever occurs sooner, the Contractor shall submit to the Architect a Waste Management Plan. The Plan shall contain the following:
 - 1. Estimate of total Project waste to be generated; name of the landfill(s) where Project waste would normally be disposed of.
 - 2. Estimate of total cubic yards of the following waste categories to be diverted from landfill:
 - a. Clean dimensional wood, pallet wood.
 - b. Cardboard.
 - 3. Estimate of amounts (weight, feet, square yards, gallons, etc.) of the following waste categories:
 - a. Metals.
 - b. Carpet.
 - c. Paint.

1.07 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Plan Distribution: The Contractor shall provide copies of the Waste Management Plan to the Job Site Foreman, each subcontractor, and the Architect.
- B. Instruction: The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.
- C. Meetings: The Contractor shall conduct Construction Waste Management meetings. Meetings shall include subcontractors affected by the Waste Management Plan. At a minimum, waste management goals and issues shall be discussed at the following meetings:
 - 1. Pre-bid meetings.
 - 2. Pre-construction meeting.
 - 3. Regularly scheduled job-site meetings.
- D. Separation Facilities: The Contractor shall designate a specific area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid co-mingling of materials. Bins shall be protected during non working hours from off site contamination.
- E. Materials Handling Procedures: Materials to be recycled shall be protected from contamination, and shall be handled, stored and transported in a manner that meets the requirements set by the designated facilities for acceptance.

- F. Hazardous Wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations.
- G. Application for Progress Payments: The Contractor shall submit with each Application for Progress Payment a Summary of the project waste generated. Failure to submit this information shall render the Application for Payment incomplete and shall delay Progress Payment. The Summary shall contain the following information:
 - 1. The amount (in tons or cubic yards) of material landfilled from the Project, the identity of the landfill, the total amount of tipping fees paid at the landfill, and the total disposal cost. Include manifests, weight tickets, receipt, and invoices.
 - 2. For each material recycled, reused, or salvaged from the Project, include the amount (in tons or cubic yards, pounds, feet, square yards, gallons, etc.); the date removed from the job site; the receiving party; the transportation cost; the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling each material. Attach manifests, weight tickets, receipts and/or invoices.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 77 19
PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. Requirements apply to this Section.

1.02 SUMMARY:

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
1. Inspection procedures
 2. Project record document submittal
 3. Operation and Maintenance Data
 4. Instruction of Owner's personnel
 5. Service and maintenance contracts
 6. Submittal of guarantees/warranties and bonds
 7. Final Cleaning
 8. Restoration of damaged and remedial work
 9. Delivery of extra materials
- B. Process individual buildings, site package and landscape package separately for project closeouts.

1.03 FINAL COMPLETION:

- A. Preliminary Procedures: Before requesting inspection for certification of Final Completion, complete the following. List exceptions in the request.
1. In the Application for Payment that coincides with, or first follows, the date Final Completion is claimed, show 100 percent (100%) completion for the portion of the Work claimed as complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of charges to the Contract Sum.
 - a. If 100 percent (100%) completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 2. Advise Construction Manager of pending insurance changeover requirements.
 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
 5. Complete final clean up requirements, including touch-up painting. Touch up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Construction Manager will either proceed with inspection scheduling or advise the Contractor of unfilled requirements. The Construction Manager will prepare the Notice of Completion following inspection or advise the Contractor of construction that must be completed or corrected before the Notice will be issued.
1. The Construction Manager will repeat inspection scheduling when requested and assured that the Work has been completed.
 2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.04 FINAL ACCEPTANCE:

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a certified copy of the Construction Manager's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and the list has been endorsed and dated by the Construction Manager.
 4. Submit record drawings, damage or settlement survey, property survey, and similar final record information.
 5. Submit consent of surety to final payment.
 6. Submit a final liquidated damages settlement statement.
 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Re-inspection Procedure: The Construction Manager will reinspect the Work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Construction Manager.
1. Upon completion of reinspection, the Construction Manager will prepare a Notice of Completion, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final completion.
 2. If necessary, the reinspection procedure will be repeated.

1.05 RECORD DOCUMENT SUBMITTALS:

- A. General: Do not use record drawings for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Owner, Construction Manager reference during normal working hours.
- B. Record Drawings: Maintain clean undamaged set of prints of Contract Drawings and Shop Drawings. Mark the set in the manner approved in advance by the Construction Manager to show the actual installation where the installation varies from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Label each document "PROJECT RECORD" in large, neat, printed letters. Failure to maintain record drawings shall result in withholding of Contractor's payment. See provisions in Section GC-2.23 – Payment, located in the General Conditions.
 - 1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
 - 2. Mark information that is important to the Owner but was not adequately shown on Contract Drawings or Shop Drawings.
 - a. Changes made by Change Order and other modifications described in the GENERAL CONDITIONS noting the change or modification source.
 - b. Locations of significant Work concealed inside the building whose general locations have been changed from those shown on the Contract Documents
 - c. Locations of items, not necessarily concealed, which have been changed, with the Architect's prior written approval, from the location shown on the Contract Documents.
 - d. Revisions to routing of piping and conduit.
 - e. Revisions to electrical circuitry.
 - f. Actual equipment locations.
 - g. Ducting Size and routing.
 - 3. Note related Change Order or Work Authorization number where applicable.
 - 4. Organize Record Drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of each set.
 - 5. Keep up to date during entire progress of the Work and furnish additional drawings as necessary for clarification. Failure to maintain record drawings shall result in withholding of Contractor's payment. See provisions in Section GC-23 – 'Payment', located in the General Conditions.
 - 6. Record deviations from the sizes, locations, and other features of installations shown in the Contract Documents.
 - 7. Establish locations of underground Work by Global Positioning Systems (GPS) and

reference invert elevations and rates of fall.

8. Give sufficient information to locate Work concealed in the building.
9. Locate main runs of piping, conduit, ductwork and similar items by dimensions.
10. Locate other items either by dimensions or in relation to spaces within the building.
11. Where feasible, the individual or entity that obtained record data, whether the individual or entity is the installer, subcontractor, or similar entity, is required to prepare the mark-up on Record Drawings.
12. Accurately record information in an understandable drawing technique.
13. Record data as soon as possible after it has been obtained. In the case of concealed installation, record and check the mark-up prior to concealment.

C. As-Built Drawings:

1. At time of acceptance of the Work and prior to final payment, using the record drawings for reference, prepare "As-Built" drawings on permanent, transparent, reproducible prints furnished by the Architect. Furnish reproducible record drawings, made from final Shop Drawings, which have been updated to show actual conditions, for Work specified in the individual Specification sections. Where Shop Drawings are marked, show cross-reference on "As Built" Drawings.
 - a. Employ and pay a professional draftsman to prepare the "As-Built" drawings from the record drawings, using typical drafting devices and recording information in ink clouding all changes.
 - b. After completing the preparation of transparency record drawings, produce three (3) copies of each Drawing, whether or not changes and additional information were recorded. Organize the copies into manageable sets. Bind each set with durable paper cover sheets, with appropriate identification, including titles, dates, and other information on cover sheets.
 - c. Organize and bind original marked-up set of prints that were maintained during the construction period in the same manner.
 - d. Organize record mylar transparencies into sets matching the print sets. Reverse roll and place these sets in durable tube-type Drawing containers with end caps. Mark the end cap of each container with suitable identification.
 - e. Sign and date the completed Project "As Builts" and transmit them to the Construction Manager, who will forward them to the Owner after final acceptance of the Work.

D. Large-Scale Coordination Drawings:

1. The preparation of large-scale, detailed coordination drawings will be required for the Work of Divisions 22, 23, 26, 27, 28 and 31 of these Specifications. These coordination drawings are not Shop Drawings as defined by the General Conditions, but, together with Shop Drawings or coordination drawings of other affected Work, are used to check, coordinate, and integrate the various types of Work.

2. If furnished, include the coordination drawings as part of the Project "As-Builts".
- E. As-Built Construction Schedule:
1. Using as a basis the latest, updated Progress Schedule required by Section 01 33 00 "Submittals," prepare and transmit a Record Construction Schedule to indicate the actual dates and durations of the various construction activities.
- F. Record Specifications: Maintain one (1) complete copy of the Project Manual, including addenda, and one (1) copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in the actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.
1. Mark each Specification SECTION to record:
 - a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually incorporated in the Work.
 - b. Changes made by Change Order and other modifications described in the GENERAL CONDITIONS
- G. Operation and Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data into individual heavy-duty 2-inch, 3-ring vinyl-covered binder, with pocket folders for folded sheet information. Mark the appropriate identification on front spine of each binder. Provide index near front of binder furnishing immediate information as to locations in the manual of all emergency data regarding the equipment included in the manual. Provide entire contents of Binder on Compact Disc organized in same sequence as binder.
1. Include the following types of information:
 - a. Emergency instructions
 - b. Spare parts list
 - c. Copies of warranties
 - d. Wiring diagrams
 - e. Recommended maintenance schedules and a list of maintenance performed during the construction process.
 - f. Inspection procedures
 - g. Shop drawings and product data
 - h. Fixture lamping schedule.
 - i. Complete nomenclature of replaceable parts, their part numbers, current cost and name and address of nearest source of parts.
 - j. Copy of each guarantee/warranty and service contract issued for the equipment

included in the manual.

- k. Delete Extraneous Data from manufacture's catalog pages, information, which is not applicable to this project installation.

- l. Video tape of Training Procedures

- 2. Submittal Schedule: Comply with the following schedule for submittal of operating and maintenance manuals.

- a. Before submittal of Request for Final Payment, when each installation that requires submittal of operating and maintenance manuals is nominally complete, submit two (2) draft copies of each manual to the Construction Manager for review. Include a complete index or table of contents.
- b. The Construction Manager will return one (1) copy of the draft with comments within fifteen (15) days of receipt.
- c. Submit one (1) copy of the manuals in final form at least fifteen (15) days before final inspection. This copy will be returned within fifteen (15) days after Final Inspection, with comments.
- d. After final inspection, make corrections or modifications to comply with the Construction Manager's comments. Submit the specified number of copies of each approved manual to the Construction Manager within fifteen (15) days of receipt of Construction Manager's comments

H. Operation Tests

- 1. Conduct systematic start-up and operational tests as required to demonstrate that all systems have been completed and are in compliance with all requirements of the Contract Documents, and are fully functioning and operational. Contractor shall coordinate his/her start-up and operational tests with contractors performing work under other bid packages.
- 2. Furnish a written record of test results using recording type instruments where applicable

- I. Upon completion of the Work, submit Close out Documents to the Construction Manager for the Owner's records.

- J. Transmit manuals in the quantity which is required to be returned, plus the following, unless otherwise specified, which will be retained by the Construction Manager for forwarding to the Owner after acceptance of the work.

- 1. Four (4) copies of Mechanical and Electrical manuals and one (1) copy on CD.
- 2. Two (2) copies of all other manuals and one (1) copy on CD.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 CLOSEOUT PROCEDURES:

- A. Owner's Training Sessions: Arrange for each installer of equipment that requires regular

maintenance to provide DVD-recorded Owner's training sessions. Arrange for each installer of equipment that requires regular maintenance, to meet with the Owner's personnel to review contractor furnished DVD-recorded instruction in the proper operation and maintenance of each component of each system. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

1. Maintenance manuals
 2. Record documents
 3. Spare parts and materials
 4. Tools
 5. Lubricants
 6. Fuels
 7. Identification systems
 8. Control sequences
 9. Hazards
 10. Cleaning
 11. Warranties, bonds
 12. Maintenance agreements and similar continuing commitments
- B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Start-up
 2. Shut-down
 3. Emergency operations
 4. Noise and vibration adjustments
 5. Safety procedures
 6. Economy and efficiency adjustments
 7. Effective and energy utilization.
- C. Schedule training to conform to personnel availability at the facility and to conclude prior to start up of system. The base duration of training shall be determined by the complexity of the system or equipment and shall be done by qualified instructors from the manufacturer or contractor.
- D. As part of the operator's training, one (1) lesson plan shall be devoted to reviewing of DVD, which shall be incorporated into the training program to allow new employees to view the DVD at their own convenience and be able to comprehend the system without the need for an instructor in attendance.
- E. Prepare one (1) set of DVDs to assist maintenance personnel in trouble-shooting the systems and making routine repairs. All DVD's shall be made at the Project facility to ensure that the video portrayal is representative of the true systems.
- F. In addition to written technical descriptions, the training shall lay out prescribed hands-on-training under the supervision of others who have previously completed the training program. The foregoing techniques are to be developed to produce a program that is self-perpetuating and permits a high level of operator training in the event of high turnover rates among those who are assigned to duties in maintenance.

3.02 FINAL CLEANING:

- A. General: General cleaning during construction is required by the General Conditions and included Section "Temporary Facilities and Controls".
1. Comply with applicable regulatory requirements during the cleaning and disposal

operations. Special cleaning requirements for specific elements of the Work are included in appropriate Sections of Division 3 through 40.

2. Use cleaning materials, which will not create hazards to health or property or cause damage to products or Work. Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
3. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to a condition acceptable to the Construction Manager. Use cleaning materials and methods recommended by the manufacturer of the products to be cleaned.
4. Schedule operations with sufficient time for surfaces to dry thoroughly to prevent dust, and other contaminants resulting from cleaning operations from adhering to wet or newly finished surfaces.

5. Complete the following cleaning operations before requesting inspection for Certificate of Completion.

- a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable as vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, grease, fingerprints, labels, spills, spatters, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Mop clean concrete floors. Vacuum carpeted surfaces.
 - d. Wipe surfaces of mechanical and electrical equipment, elevator equipment and similar equipment. Remove excess lubrication, paint, mortar droppings and other foreign substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps vacuum inside of electrical panels and cabinetwork.
 - e. Clean the Site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
 - f. Clean permanent filters and replace disposable filters of units operated during construction.
 - g. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - h. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
 - i. Touch up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored, or show evidence of repair or restoration. Do not paint over "UL" and similar labels including mechanical and electrical nameplates.
6. Pest Control: Engage an experienced exterminator to make a final inspection, and to rid

Project of rodents, insects, and other pests.

7. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
8. Compliances: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
9. Materials remaining after completion of associated Work shall be disposed of or stored as directed by the Construction Manager.

END OF SECTION

SECTION 01 78 36

WARRANTIES AND BONDS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General Conditions and Supplemental General Conditions and other Division 01 General Requirements, apply to this Section.

1.02 SUMMARY:

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties. Contractor will review guarantee/warranty and bonds to verify compliance with Contract Documents.
 - 1. Refer to Article GC-31 of the General Conditions and the separate Guaranty of workmanship and materials.
 - 2. General closeout requirements are included in Section 01 77 19 "Project Closeout."
 - 3. Specific requirements for warranties of the Work and products and installations that are specified to be warranted, are included in the individual Sections of Division - 3 through Division -40. If no specific information is included in individual sections of the specifications, warranty period shall be as follows: Manufacturer's warranties notwithstanding, warrant the entire Work against defects in materials and workmanship for twelve (12) months from date of Notice of Completion.
 - 4. Certifications and other commitments and agreements for continuing services to the Owner are specified elsewhere in the Contract Documents.
 - 5. The Contractor will not be responsible for defects due to misuse, negligence, willful damage, improper maintenance, or accident caused by others, nor shall he be responsible for defective parts whose replacement is necessitated by failure of the Owner's maintenance forces to properly clean and service them, provided the Contractor has furnished complete maintenance instructions to the Owner.
- B. 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, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.03 BOND REQUIREMENTS

- A. Each bond specified in this Article (faithful performance bond, payment bond and warranty bond) shall meet the requirements of all applicable statutes, including but not limited to those specified in Public Contract Code section 20129 and Civil Code section 3248.
- B. Each bond specified in this Article shall be issued by a surety company designated as an admitted surety insurer in good standing with and authorized to transact business in this state by the California Department of Insurance, and acceptable to the County of Madera. Bidders are cautioned that

representations made by surety companies will be verified with the California Department of Insurance. Additionally, the County of Madera, in its discretion, when determining the sufficiency of a proposed surety company, may require the surety company to provide additional information supported by documentation. The County of Madera generally requires such information and documentation whenever the proposed surety company has either a Best's Key Rating Guide of less than B+ or a financial size designation of less than VIII. Provided, however, that the County of Madera expressly reserves its right to require all information and documentation to which the County of Madera is legally entitled from any proposed surety company.

- C. Payment and Performance Bonds. The successful bidder shall furnish a faithful performance bond in the amount of 100 percent of the Contract Amount and a payment bond in the amount of 100 percent of the Contract Amount.
- D. Warranty Bond. Prior to Final Payment, Contractor shall post a one (1) year Warranty Bond, issued by the surety company that issued the payment and performance bonds, or if approved by Owner, by another surety company that meets the requirements of this Article and is acceptable to Owner, in the amount of ten percent (10%) of the Final Contract Price.

1.04 DEFINITIONS RE: WARRANTIES:

- A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special 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.

1.05 WARRANTY REQUIREMENTS:

- A. Related Damages and Losses: When correcting warranty Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranty Work.
- B. 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.
- C. Replacement Costs: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of 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.
- D. Owner's Recourse: Written 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, nor shall warranty periods be interpreted as limitations on 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 selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty,

certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.06 SUBMITTALS RE: WARRANTIES:

- A. Submit written warranties to the and Construction Manager upon request of the or Construction Manager, and in any event prior to any request by Contractor for final acceptance of the Work. The commencement date for warranties applicable to the Work shall be the date of acceptance of the Work as specified in the Notice of Completion, unless otherwise noted in the Contract Documents (e.g., as to manufacturer's warranties for equipment).
 - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Construction Manager within ten (10) days of completion of that designated portion of the Work.
 - 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
- B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Construction Manager for approval prior to final execution.
 - 1. Refer to individual Sections of Division - 3 through Division - 40 for specific content requirements, and particular requirements for submittal of special warranties.
 - 2. Submit the Guarantee/Warranty typed on the Contractor's letterhead if for the entire Work, or on the Subcontractor's letterhead if for the Work of a Specification Section.
- C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind warranties and bonds into heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper. Provide separate binders for each building, site and landscape package.
 - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the installer.
 - 2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.
 - 3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
- E. Time of Submittal
 - 1. Submit guarantees/warranties within ten (10) days after date of Notice of Completion, prior

to request for Final Payment.

2. For items of Work where acceptance is delayed materially beyond the date of Notice of Completion, furnish updated submittal within ten (10) days after such delayed acceptance, listing the date of delayed acceptance as the start of the guarantee/warranty period.

1.07 REVIEW MEETING:

- A. Eleven (11) months following date of acceptance of the Work, hold a meeting for the purpose of review of, and action upon, guarantees/ warranties, bonds, and service and maintenance contracts, as specified in Section 01 31 19 "PROJECT MEETINGS".

1.08 SERVICE AND MAINTENANCE CONTRACTS

- A. Compile, review, and transmit specified service and maintenance contracts as specified for guarantees/warranties and bonds.

1.09 PREPARATION FOR FINAL INSPECTION

- A. Perform final cleaning as specified hereinbefore.
- B. Assemble guarantees/warranties, service and maintenance contracts, operating and maintenance instructions, and other items as specified, and transmit to the Construction Manager, who will forward them to the Owner after final acceptance of the Work.

1.10 RESTORATION OF DAMAGED WORK

- A. Restore or replace, as specified or determined by the Architect, material and finishes damaged from construction activities at no additional expense to the Owner.
- B. Restoration shall be equal to the original Work, and finishes shall match the appearance of existing adjacent Work.

1.11 REMEDIAL WORK

- A. Remedial Work necessary owing to faulty workmanship or materials shall be at no additional expense to the Owner.
- B. Work shall be coordinated with the Owner and performed at such time and in such manner to cause minimal interruption and inconvenience to the Owner's operations.

1.12 EXTRA MATERIALS

- A. Where required in the individual Specification SECTIONS, furnish extra materials in the quantities and manners specified. Prior to submitting any materials submit a list of all extra material required in the specification sections.
- B. Delivery and certification of such extra materials shall be a prerequisite to Notice of Completion.
- C. Deliver extra materials directly to Owner for sign-off.
- D. Package in clearly identifiable boxes.
- E. Indicate manufacturer's name, part name, and stock number.

F. Indicate piece of equipment part or tool is for.

G. Indicate name, address and phone number of closest supplier.

1.13 MISCELLANEOUS RECORD SUBMITTALS

Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Final Acceptance, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Construction Manager for the County of Madera's records.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION

SECTION 01 78 36.2

SUBCONTRACTOR/SUPPLIER WARRANTY

We the undersigned hereby warrant that Specification Section No.

(Enter Specification Section)

titled: _____, which has been installed at

(Specification Title / Scope of Work)

Madera County Courthouse Park Renovation Project

(Enter the Name of the Project)

Madera
(Enter City)

County of Madera, California
(Enter County & State)

has been performed/supplied in accordance with the Contract Drawings and Specifications, and should any of the materials or equipment prove defective or should the work as a whole prove defective, due to faulty workmanship, material furnished or methods of installation, or should the work or any part thereof fail to operate properly as originally intended and in accordance with the plans and

specifications, due to any of the above causes, all within _____ year(s) after the date on which this contract is accepted by the Owner, the undersigned agrees to reimburse the Owner, upon demand, for its expenses incurred in restoring said work to the condition contemplated in said project, including the cost of any such equipment or materials replaced and the cost of removing and replacing any other work necessary to make such replacement or repairs, or upon demand by the Owner, to replace any such material and to repair said work completely without cost to the Owner so that said work will function successfully as originally contemplated.

The Owner shall have the unqualified option to make any needed replacement or repairs itself or to have such replacements or repairs done by the undersigned. In the event the Owner elects to have said work performed by the undersigned, the undersigned agrees that the repairs shall be made and such materials as are necessary shall be furnished and installed within seven (7) calendar days after the receipt of demand from the Owner. If the undersigned shall fail or refuse to comply with their obligations under this guaranty, the Owner shall be entitled to all costs and expenses reasonably incurred by reason of said failure or refusal.

Signed:

(Signature)

(Print Name)

(Title)

(Date)

(Enter the Subcontractor / Supplier Name)

(Address)

(City, State, Zip Code)

(Area Code & Phone Number)

END OF SECTION

SECTION 02 41 00**DEMOLITION****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Remove all items within the limits of Work shown and specified on the Contract Drawings. Shore existing framing as required. Do not remove anything beyond the limits of Work shown without prior approval of the Architect, prior to proceeding. Refer to Construction Staging and Demolition Drawings.

1.02 REFERENCES

- A. Requirements of the GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC).
- C. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to Work of this Section where cited by abbreviations noted below:
 - 1. National Standards Institute, Inc.
 - a. A10.6 - "American National Standard Safety Requirements for Demolition."

1.03 QUALITY ASSURANCE

- A. Protect existing structures, facilities, and plant life from damage. Items damaged as a result of demolition operations shall be repaired or replaced, as required, at no increase in Contract Price.
- B. Perform Work so as to provide the least interference and most protection to existing facilities and improvements to remain. Provide Architect with 72-hour notice of commencement of operations.
- C. No blasting will be permitted.
- D. Protection:
 - 1. Provide as necessary to protect public, the Owner's employees, finishes and improvements to remain and adjoining property from damage, all in accordance with applicable regulations.
 - 2. Refer to Section 01 57 00, Temporary Controls, for Dust and Dirt Control.
- E. Salvage Materials: Carefully remove, protect and deliver to Owner the following salvage materials: Doors, door frames, finish hardware, window hardware, cabinetwork, plumbing fixtures and trim, electrical light fixtures and equipment, signs, etc., as directed. Salvage

sufficient existing acoustic and resilient tiles to patch and replace tile Work altered or damaged during alteration Work as directed.

1.04 SUBMITTALS

- A. Submit to Project Structural Engineer detailed information on methods and sequencing for accomplishing this Work. Employ a Structural Engineer registered in the State of California to develop such methods, shoring and demolition sequences.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine areas affected by Work of this Section and verify the following:
 - 1. Disconnection of utilities as required.
 - 2. That utilities serving occupied portions of building will not be disturbed.
 - 3. Shoring is in place.
 - 4. Removal by Owner of the Owner's personal property, movable furniture, and equipment items not designated for relocation has been completed.
- B. Where existing conditions conflict with representations of the Contract Documents, notify the Architect and obtain written clarification before proceeding.
- C. Do not commence until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Lay out cutting Work at jobsite and coordinate with related Work for which cutting is required.

3.03 DEMOLITION

- A. Perform Work in accordance with ANSI A10.6 unless otherwise specified.
- B. Demolition shall be continuously monitored by Contractor's Structural Engineer.
- C. Demolish concrete and steel in small sections. Do not permit material to fall on or in existing buildings. Remove all loading before cutting or removing structural members. Cut existing concrete reinforcement as directed.
- D. Restrict all concrete and steel cutting, drilling, chipping, sawing, etc., to times which do not interfere with hospital functions. Perform Demolition Work only with authorization from Owner at mutually agreeable times. Notify Owner four (4) working days in advance. Comply with SECTION 01 57 00, "TEMPORARY CONTROLS," for Noise Controls.

- E. Perform demolition as much as possible with small tools.
- F. Jackhammering:
 - 1. Jackhammering will be permitted only to limited degree, with prior approval of Architect.
 - 2. Prior to jackhammering, consult existing As-Built Drawings. Do not jackhammer within 2-inches of reinforcing or structural steel to remain; remove final 2-inches of material with chipping gun.

3.04 CUTTING

- A. General Requirements:
 - 1. Cut or drill new openings to correct size as shown or required. Undercut openings where steel reinforcement, framing, or spandrel trusses exist so that designed segments of steel remain exposed in the final openings to accomplish required structural modifications, connections, etc. Saw-cut and chip concrete away from existing steel to remain to establish full opening required for structural alterations. Review with Architect location of all openings and holes required for pipes, ducts, conduits, etc., not shown before cutting or drilling. Do not overcut.
 - 2. Make new openings neat; approximate profiles shown.
 - 3. Take care not to damage reinforcing or structural steel to remain.
 - 4. Coring of slabs and walls will be permitted.

3.05 PATCHING

- A. Repair or replace any surfaces which become exposed, defaced, or damaged as a result of Alterations or Demolition Work at no increase in Contract Price. Make all such repairs with materials equal in kind and quality to match existing adjacent surfaces. Where existing wall, partitions, or ceilings are removed, patch adjacent floor, wall, and ceiling surfaces to match existing, unless otherwise noted. Repaint patched surfaces to nearest change of plane.

3.06 REMOVALS

- A. All trucks hauling salvage and debris from the site must have tarp over the load.
- B. Remove from jobsite and legally dispose salvage and debris so as not to delay progress of related Work.

END OF SECTION

SECTION 02 41 19.13**SELECTIVE BUILDING DEMOLITION****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Selective demolition of building elements.
 - 1. Protect items in place as indicated on the Drawings.
 - 2. Demolish and remove items as indicated on the Drawings.
 - 3. Remove, salvage, and reinstall items as indicated on the Drawings.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Division 01 - General Requirements: For requirements for submittals, temporary protection, and cutting and patching.

1.02 REFERENCES

- A. ANSI - American National Standards Institute
 - 1. A10.6 - Safety Requirements for Demolition Operations.
- B. EPA - Environmental Protection Agency
- C. NFPA - National Fire Protection Association
 - 1. 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.03 DEFINITIONS

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
- B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.
- C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.
- D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.
- E. Materials Ownership: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.04 SUBMITTALS

- A. Procedures: In accordance with Division 01.

- B. Qualification Data: For demolition firm if not provided by Contractor.
- C. Pre-demolition Photographs and Details: Show existing conditions in areas where demolition work will be performed, both interior and exterior, including finish surfaces, items to be salvaged, and items to be re-installed, that might be misconstrued as damage caused by demolition operations. Submit before work begins.
- D. Inventory of Salvaged Items: After demolition is complete, submit a list of items that have been removed and salvaged.
 - 1. Include at least one digital photograph of each item, numbered and clearly labeled to correspond with inventory.
 - 2. Provide written Table of Contents for inventory.
 - 3. Indicate original location(s) of each item or type of item.
 - 4. Indicate whether or not the item is to be re-installed. If it will be re-installed, indicate repair or restorative work required and location of re-installation.
- E. Demolition, Salvage, and Re-Installation Plan as specified.
- F. Receipts for recycled materials that include name of licensed recycling company, dollar value, and date.

1.05 DEMOLITION, SALVAGE, AND RE-INSTALLATION PLAN

- A. Submit a complete Demolition, Salvage, and Re-Installation Plan detailing procedures and sequence for the following:
 - 1. Removal of existing construction and facilities including stack stone, interior wood, and all features necessary to remove portions of the existing building for new work in a safe and controlled manner to ensure stability, weathertightness, and security of the existing building at any given time.
 - 2. Removal, salvage, transportation, storage, and re-installation of items to be re-installed.
 - 3. Submit detailed information on methods and sequencing for accomplishing this work. Employ a Structural Engineer registered in the State of California to develop such methods and demolition sequences.
- B. Thoroughly investigate the condition of the existing structures before proceeding with the Demolition, Salvage, and Re-Installation Plan.
- C. The Demolition, Salvage, and Re-Installation Plan shall consist of the following:
 - 1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
 - 2. Interruption of utility services.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Details and locations of temporary and exterior protective measures to ensure that people, property and improvements to remain will not be endangered or damaged.
 - 5. Access routes for hauling debris and salvaged items from building.
 - 6. Coordinate schedule of activity for hazardous materials removal and other work contracted directly by Owner.
- D. In the event that modifications to the Demolition, Salvage, and Re-Installation Plan are required to be submitted for approval, the Contractor shall provide 14 calendar days for the review of substantial procedural and sequence modifications.
- E. Review by the Architect and Owner of the Demolition, Salvage, and Re-Installation Plan, or field observations performed by the Architect, will in no way relieve the Contractor of full responsibility for the Demolition, Salvage, and Re-Installation Plan and procedure.

1.06 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: A firm with documented specialized experience in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.
- D. Pre-demolition Conference
 - 1. Conduct conference at Project site. Conference shall be attended by Contractor, Owner, Architect, demolition contractor if applicable, and others whose work is affected by demolition operations.
 - 2. Pre-demolition photographs and details shall be complete and accepted by Architect before conference takes place.
 - 3. Notify participants a minimum of 48 hours prior to time of conference.
 - 4. Review methods and procedures related to demolition including, but not limited to, the following:
 - a. Pre-demolition photographs must be complete and acceptable to Architect and Owner.
 - b. Inspect and discuss condition of construction to be demolished.
 - c. Review and finalize Demolition, Salvage, and Re-Installation Plan and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Review and finalize protection requirements.
 - 5. Record discussions of conference and any conflict, incompatibility, or inadequacy. Furnish a copy of record to each participant.

1.07 TRAFFIC

- A. Conduct demolition operations and the removal of debris to ensure minimum interference with streets, walks, and adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from the Owner, and, where applicable, from other authorities having jurisdiction.
- B. Existing pedestrian walks shall be kept open at all times unless otherwise approved by the Owner. Any closings or disruptions of existing site circulation, if required, shall be included in the Demolition Plan.
- C. Full compensation for temporary vehicular and pedestrian controls shall be considered as included in the Contract Lump Sum Price and no additional compensation will be allowed for this purpose.

1.08 PROJECT CONDITIONS

- A. Conditions existing at time of inspection for bidding purposes will be maintained by the Owner as far as practical.
- B. Coordinate the performance of work in this Section with related or adjacent work.
- C. Protection of items should be completed prior to commencement of new construction and demolition procedures. At the end of working day or during inclement weather, cover work exposed to weather with waterproof coverings, securely anchored.

- D. Asbestos and lead paint may be encountered in the Work. If any materials suspected of containing asbestos or lead paint are encountered, do not disturb the materials. Immediately notify the Architect and the Owner's Representative.

PART 2 - PRODUCTS

2.01 PROTECTION MATERIALS

- A. Polyethylene Sheets: 4 mil.
- B. Lumber: Species to be selected by the Contractor, with sizes to fit field conditions. Lumber shall be fire retardant treated.
- C. Plywood: 1/2-inch or 3/4-inch fire retardant treated.
- D. Soft Fiberboard
 - 1. 1/2-inch Homasote.
 - 2. 1/2-inch NCFR Homasote for exposed locations.
- E. Neoprene: 1/4-inch or 1/2-inch strips stock sizes.
- F. Polyurethane Foam Sheets: 4-inches thick.
- G. "Preservation" Tape: As manufactured by 3M, "Scotch Brand No. 4811"; American Biltrite Inc.; Surface Armor, or approved equal.
- H. Plastic Film Tape: As manufactured by 3M, "Scotch Brand No. 472"; American Biltrite Inc.; Surface Armor, or approved equal.
- I. Kraft Paper.
- J. Accessories: Provide necessary and related parts, fasteners, devices and anchors required for complete installation.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of demolition required.
- B. Inventory and record the condition of any items required to be removed and salvaged. Where appropriate, provide at least one digital photograph.
- C. When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to Architect and Owner.
- D. Perform an engineering survey of condition of existing buildings to determine whether removing any unanticipated element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- E. Hazardous materials will be remediated by Owner under separate contract. Coordinate with Owner's separate contractor, to ensure that hazardous materials are removed or remediated before proceeding with demolition operations in the affected area.

3.02 PREPARATION

- A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities to be removed or abandoned.
 - 1. Arrange to shut off indicated utilities with Owner and utility companies when applicable.
 - 2. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
- B. Temporary Shoring: Provide and maintain shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of existing construction.
 - 1. Strengthen or add new supports when required during progress of demolition.
 - 2. All work shall be designed by Contractor's Structural Engineer.
- C. Comply with the following:
 - 1. Clean salvaged items of dirt and demolition debris.
 - 2. Make a written inventory of all salvaged items as specified in Part 1, noting original location, condition, and any significant damage or deficiencies.
 - 3. Pack or crate items after cleaning. Identify contents of containers and number to correspond with inventory.
 - 4. Store items in a secure area until re-installation or until delivery to Owner, as applicable.
 - 5. Transport items to Owner or to new location in building as applicable.
 - 6. Protect items from damage during transport and storage.

3.03 POLLUTION CONTROLS

- A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- C. Clean adjacent site areas of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.04 INSTALLATION OF PROTECTION

- A. General
 - 1. Alternative methods to specified protection may be acceptable if equal or greater protection is provided. Submit alternative methods to the Architect for review as specified. Do not proceed with alternative methods until specified approvals are secured. Mockups may be required.
 - 2. Protection may be required to remain in place for the duration of the Project. As such, materials shall be installed to provide adequate protection throughout the full extent of construction activities. Repair or reinstall protection as required throughout the duration of construction. Changes to protection shall be proposed to the Architect for approval prior to making changes.
 - 3. All protection assemblies should be self-supporting and self bracing, and secured at the base, unless otherwise noted.
- B. Existing Facilities: Protect adjacent walkways, buildings, and other facilities during demolition operations.
- C. Temporary Protection: Comply with requirements in Division 01.

3.05 SELECTIVE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:
 - 1. 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. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Do not use cutting torches until work area is cleared 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.
 - 4. 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. Dispose of demolished items and materials promptly.
 - 7. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.
- B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.
 - 1. Use a pacometer to locate all existing rebar within any existing concrete to be demolished. Before drilling or cutting any rebar, obtain bar-by-bar permission in writing from the Architect.
- C. Sawcutting: As indicated on the Drawings; use 1/8-inch wide diamond concrete blade, made by Soff-Cut, "XL6-3000", or approved equal.

3.06 SITE RESTORATION

- A. Rough grade below-grade areas, where slabs and sidewalks are removed, ready for further excavation or new construction.
- B. Completely fill voids resulting from building demolition operations that will not be required by new construction with satisfactory soil materials.

3.07 PATCHING AND REPAIRS

- A. Cutting and Patching: As specified in Division 01.
- B. All parts of the existing buildings indicated to remain and damaged by demolition operations shall be repaired and refinished or replaced to match existing.
- C. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
- D. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- E. Repairs to damaged brick joinery may require epoxy injection and re-pointing. Notify Architect of any damage prior to repair.

3.08 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal
 - 1. Transport demolished materials off Owner's property and legally dispose of them.
 - 2. When hauling is done over highways or city streets, loads shall be trimmed and the vehicle shelf areas cleaned after each loading.
 - 3. Contractor shall pay all permit and disposal fees for off-hauled materials.

3.09 CLEANING

- A. Sweep the building broom clean on completion of selective demolition operation.
- B. All residue and debris from protection work shall be removed from existing construction leaving the premises clean and neat.

3.10 SELECTIVE DEMOLITION SCHEDULE

- A. Remove the Following: Demolished site construction materials. All trucks hauling loads of debris from site shall provide a tarp over each load to prevent materials leaving truck bed in transit.

END OF SECTION

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SECTION 03 10 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in-place concrete.
- B. Form openings for mechanical and electrical work.
- C. Coordinate installation of items supplies under other specification sections.

1.02 RELATED SECTIONS

- A. Section 03 30 00: Cast-in-Place Concrete
- B. Section 03 20 00: Concrete Reinforcing
- C. Mechanical and electrical items to be embedded in concrete.

1.03 QUALITY ASSURANCE

- A. Design Requirements:
 - 1. All work shall California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC).
 - 2. Responsibility: Design of formwork is the Subcontractor's responsibility. Comply with the following, except as modified by the Building Code or these specifications.
 - a. ACI 301 - "Specifications for Structural Concrete for Buildings."
 - b. ACI 347 - "Recommended Practice for Concrete Formwork."
 - c. ACI 303R - "Guide to Cast-in-Place Architectural Concrete Practice."
 - 3. Allowable Tolerances:
 - a. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347.
 - b. Note special tolerance requirements for locations of drains where indicated on drawings.

1.04 SUBMITTALS

- A. Product Data: Submit Manufacturer's data and installation instructions for proprietary materials such as form coatings, manufactured form systems, ties and accessories.
- B. Submit manufacturer's certification that form release agent will provide clean, stainfree surfaces of concrete and not interfere with bond of applied finishes.
- C. Shop Drawings: Submit shop drawings for form snap ties and control joint layout.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver form release agents in manufacturer's sealed and trademarked containers.

PART 2 - PRODUCTS**2.01 FORM MATERIALS**

- A. General: Form material shall be as required to produce continuous, straight, smooth exposed surfaces. Materials selected shall be satisfactory to Architect for effect on finished appearance of concrete. Architectural concrete formwork shall be of one material throughout the work, for all similar types of concrete surfaces.
- B. Exposed Non-Architectural Concrete:
 - 1. Metal or APA graded Plyform, Grade BB, Class I or II, or HDO plywood exterior type, each piece graded, no mill oiling. Use one form face material throughout the project for similar types of concrete surfaces.
 - 2. Provide material and bracing with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- C. Exposed Architectural Concrete:
 - 1. Metal or APA graded Plyform, Grade A with smooth surface free of defects to produce smooth concrete finish, each piece graded, no mill oiling. Use one form face material throughout the project for similar types of concrete surfaces.
Submit form material for review and approval by Architect
 - 2. Provide material and bracing with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- D. Concealed Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least 2 edges and 1 side. "Concealed" means not visible in the completed structure. (Painted concrete is not to be considered "concealed".)
- E. Form Ties:
 - 1. Provide snap ties with plastic cones of same size and shape and of same manufacturer as cement cone hole plugs provided under Concrete Section.
 - 2. Wire ties and site fabricated ties and wood separators are not acceptable.
- F. Form Coatings: Commercial formulation resin-based form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond, or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds. Oils and petroleum distillates are not acceptable. Verify compatibility of form coating with proposed surface finish.
- G. Metal Inserts: Provide metal inserts for anchorage of materials or equipment to concrete construction, where not supplied by other trades and required for the work.
- H. Earth forms permitted for footings.

2.02 FORMWORK SYSTEMS

- A. Design, erect, support, brace and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.

- B. Design forms to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structuring during construction.
- C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Provide formwork sufficiently tight to prevent leakage of cement past during concrete placement. Solidly butt and gasket joints and provide backup material at joints to prevent leakage and fins.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine surfaces and conditions receiving or affecting the work. Do not proceed until unsuitable conditions have been corrected.

3.02 FORM CONSTRUCTION

- A. General: Construct forms complying with ACI 347 and ACI 303R, as applicable to the sizes, shapes, lines and dimensions shown, and to accurate alignment, location, grades, levels, and plumbness. Provide for openings, sleeves, offsets, recesses, reglets, chamfers, inserts, and other features required. Use selected materials to obtain required finishes. Before placing concrete, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming system.
- B. Ties:
 - 1. Spacing: Space ties in a uniform pattern as indicated in the architectural drawing and conforms to the approved shop drawings. Rest cones firmly against forms and seal to prevent leakage.
- C. Corner Treatment:
 - 1. Make all corners chamfered.
 - 2. Form chamfers with 3/4" x 3/4" strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
 - 3. Concealed corners may be formed either square or chamfered.
- D. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Size and location of openings, recesses and chases are the responsibility of the trade requiring such items. Accurately place and securely support items built into forms. Openings for doors and windows shall be formed with a tolerance of minus 0" and plus 1/2" from indicated dimensions.
- E. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

- F. Earth Forms:
 - 1. Construct wood edge strips at top sides of excavations.
 - 2. Provide forms for footings wherever concrete cannot be placed against solid earth excavation.
 - 3. Remove loose dirt and debris prior to concrete pours.
 - 4. Foundation concrete may be placed directly into neat excavations provided the foundation trench walls are stable as determined by the Geotechnical Engineer.
 - a. The horizontal dimensions of unformed concrete footings shall be increased 1 inch at every surface at which concrete is placed directly against the soil.
 - b. The minimum formwork shown on the drawings is mandatory to ensure clean excavations immediately prior to and during the placing of concrete.
- G. Footings and Grade Beams:
 - 1. Provide forms for footings and grade beams if soil or other conditions are such that earth trench forms are unsuitable.
- H. For slabs-on-grade, secure edge forms in such a manner as to not move under weight of construction loads, construction and finishing equipment, or workers

3.03 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, concrete. Use top and bottom templates, setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.
- B. Coordinate and schedule the work of this Section with the work of other Sections required to be set in, on, or contiguous with forms.
- C. Anchor bolts out of position or plumb by more than 1/4" shall be reinstalled in correct position and plumb at no increase in Contract Price.

3.05 REMOVAL OF FORMS

- A. Remove forms completely. Exposed surfaces of concrete shall be clean, smooth and free of irregularities.
- B. Form Ties:
 - 1. Do not remove ties until concrete has hardened sufficiently to permit removal without damaging concrete. Do not spall concrete on exposed surfaces. Pull ties of type that are wholly withdrawn from the wall toward the inside face. Cutting ties back from face of wall will not be permitted. Plug tie rod holes as specified in Concrete Section.
- C. Do not pry against face of concrete. Use wooden wedges only.
- D. Forms:
 - 1. Remove forms in manner to ensure safety of members. Do not disturb supporting forms until concrete has hardened sufficiently to permit removal with safety and without damage to concrete surface. Construct forms to permit their removal without disturbing the original shoring.

2. Time of Removal: Time of removal will depend on weather conditions, the results of cylinder tests and effectiveness of curing. The following periods between depositing of concrete and removal of forms shall be considered a minimum, which may be extended if deemed necessary by the Architect. Subject to the requirements of paragraph A above, forms for walls may be removed after 8 hours of completing concrete placement.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel bars for cast-in-place concrete, complete with tie wire.
- B. Support chairs, bolsters, bars supports, spacers, and other accessories for reinforcing.

1.02 RELATED SECTIONS

- A. Section 03 10 00: Concrete Formwork.
- B. Section 03 30 00: Cast-in-Place Concrete.

1.03 QUALITY ASSURANCE

- A. Perform concrete reinforcing work in accordance with CRSI 63 and 65 and ACI 301, 315 and 318, unless specified otherwise in this Section.
- B. The Owner's Testing Agency will:
 - 1. Provide tests in accordance with the California Building Code (CBC) Section 1913A.2.
 - 2. Collect mill test reports for reinforcement.
 - 3. Take samples from bundles at fabricators:
 - a. When bundles are identified by the heat number and accompanied by mill analysis, two specimens shall be taken from each ten (10) tons, or fraction thereof, of each size and grade.
 - b. When reinforcement is not positively identified by the heat numbers or when random sampling is intended, two specimens shall be taken from each 2-1/2 tons, or thereof, of each size and grade.
 - c. All costs associated with the test of reinforcing that not have mill test reports will be at the contractor's expense.
 - 4. Test for tensile and bending strengths.

1.04 REFERENCES

- A. California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC).
- B. ACI 301 - American Concrete Institute - Specification for Structural Concrete for Buildings.
- C. ACI 315 - American Concrete Institute - Details and Detailing of Concrete Reinforcement.
- D. ACI 318 - Building Code Requirements for Reinforced Concrete.
- E. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.

- F. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.05 SUBMITTALS

- A. Submit shop drawings including appropriate plans and details. Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules, and supporting and spacing device.

PART 2 - PRODUCTS

2.01 REINFORCING

- A. Reinforcing Steel: 60 ksi yield grade; deformed type as indicated on drawings.
 - 1. Bars: Billet steel, ASTM 615; as indicated.
 - 2. Finish: Plain unless indicated galvanized on drawings or so specified.

2.02 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16-gage annealed type, or patented system accepted by Architect.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcing during construction conditions.

2.03 FABRICATION

- A. Fabricate concrete reinforcing in accordance with ACI 315.
- B. Locate reinforcing splices, not indicated on drawings, at points of minimum stress. Location of splices shall be reviewed by Architect.

PART 3 - EXECUTION

3.01 PLACEMENT

- A. Place reinforcing supported and secured against displacement. Do not deviate from true alignment.
- B. Place reinforcing to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcing in position during concrete placement operations.
- C. Before placing concrete, ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings, which would reduce bond to concrete.

3.02 FIELD QUALITY CONTROL

- A. General: The Owner's Testing Laboratory shall test and inspect concrete reinforcement and embedded assemblies as Work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Design Professionals for final acceptance.

- B. Owner's Testing Laboratory shall provide qualified personnel at site to inspect reinforcement and embeds using the latest Drawings and reviewed shop drawings, as follows:
 - 1. Prior to placement, inspect reinforcement and embeds for grade, quality of material, absence of foreign matter, and for suitable storage.
 - 2. Provide continuous inspection of reinforcement and embedded assemblies during placement and immediately prior to concreting operations for: size, quantity, vertical and horizontal spacing and location, correctness of bends and splices, mechanical splices, clearances, compliance with specified tolerances, security of supports and ties, concrete cover, and absence of foreign matter.
 - 3. Inspect epoxy-coated reinforcement for coating damage and required applied coatings.
- C. Owner's Testing Laboratory shall submit inspection, observation, and/or test reports to the Design Professionals as required herein and shall provide an evaluation statement in each report stating whether or not concrete reinforcement and embedded assemblies conforms to requirements of Specifications and Drawings and shall specifically note deviations there from.
- D. Immediately report deficiencies to the Contractor. Contractor shall prepare proposed remedy for deficiency. Contractor shall present proposal to the Design Professionals for approval. After an approved proposal is accepted by the Design Professionals, the Contractor shall correct the deficiency at no cost to the Owner.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cast-in-place concrete footings, foundations and grade beams.
- B. Cast-in-place walls.
- C. Floors and slabs on grade.
- D. Cast-in-place equipment pads.
- E. Surface finish of floors and walls.
- F. Preparation of concrete base slabs to receive toppings.

1.02 RELATED WORK

- A. Section 03 10 00: Concrete Formwork.
- B. Section 03 20 00: Concrete Reinforcement.
- C. Divisions 15 and 16: Mechanical and electrical items to be cast in concrete.

1.03 QUALITY ASSURANCE

- A. Perform cast-in-place concrete work in accordance with ACI 318, unless specified otherwise in this Section.
- B. Inspection and testing will be performed by owner's testing laboratory.

1.04 SUBMITTALS

- A. Submit in accordance with Section 01 33 00: Submittal Procedures.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm and Architect and Engineer for review prior to commencement of work.
- D. Three concrete test cylinders will be taken not less than once for every 50 cubic yards of concrete placed or not less than once a day for each class of concrete placed by special inspector.
- E. The cement supplier shall submit certification of compliance in accordance with CBC Section 1913A.1.
- F. One additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions as concrete it represents.
- G. One slump test will be taken for each set of test cylinders taken.
- H. The manufacturer of transit-mix concrete shall deliver to job inspector a certificate with each mixer truck. Certificate shall bear signature of representative of Testing Laboratory, stating quantity of

cement, water, fine aggregate, coarse aggregate, and admixtures contained in load. Certificates shall indicate time, to the nearest minute, that batch was mixed.

1.05 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 318 - Building Code Requirements for Reinforced Concrete
2. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing concrete.
3. ACI 301 - Specifications for Structural Concrete for Buildings.
4. ACI 305 - Hot Weather Concreting.
5. ACI 306 - Cold Weather Concreting.

B. All work shall be done in accordance with California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC).

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: Portland, Type II; ASTM C150. Gray, except where noted, supplement with the following:

1. Fly Ash: 25 percent maximum; Fly Ash shall conform to ASTM C618 Class N or F.
2. Combined Fly Ash and Pozzolan: 25 percent maximum
3. Ground Granulated Blast Furnace Slag: 50 percent maximum
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast Furnace Slag: 50 percent maximum with combined Fly Ash and Pozzolans not exceeding 25 percent

B. Fine and Coarse Aggregates: ASTM C33 for normal weight concrete. Aggregate shall be from established sources with proven history of successful use in producing concrete with minimum shrinkage. The average drying shrinkage after 28 days shall not exceed 0.045 percent for hardrock concrete.

C. Water: Clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.

D. Source of aggregate shall remain constant for the duration of the work, as practical.

2.02 ADMIXTURES

A. Provide admixtures meeting the requirements specified below from one of the following manufacturers: W.R. Grace Construction Materials; BASF; Sika Corp; or equal product substituted per Section 01 63 00.

1. Water-Reducing Admixture: ASTM C494, Type A, non-lignini sulfonate.

2. Air Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other products.

3. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C494, Type F or Type G.

4. Water Reducing, Accelerator Admixture: ASTM C494, Type E.

5. Water Reducing, Retarding Admixture: ASTM C494, Type D.

6. Water proofing admixture: Same as Xypex Chemical Corporations "Xypex". Admixture quantities shall be approved by the Architect. See construction drawings for locations where waterproofing admixture is required.

7. Other Admixtures: Only as approved by the Architect.

2.03 ACCESSORIES

- A. Bonding Agent: "Anvil Bond" as manufactured by Master Builders or approved equal.
- B. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2400 psi in two days and 6000 psi in 28 days.
- C. Absorptive Mats: Cotton fabric or burlap-polyethylene, minimum 8oz./sq. yd; bonded to prevent separation during handling, placement and curing.
- D. Liquid Membrane-Forming curing Compound: Conforming to ASTM C309, Type I, and which will not discolor concrete or affect bonding or other finish applied thereover, and which restricts loss of water to not more than 0.500 grams per sq. cm. of surface when tested per ASTM C156.
- E. Provide Fly Ash or other reclaimed cementitious materials as indicated in Section 2.01.A.
- F. Slab-Leveling Compound. Provide leveling compound where required to meet floor flatness and levelness requirements. Acceptable products include Ardex SD-L, Burke 300 Durock or approved equal.
- G. Waterstop: Provide waterstop ADCOR 500S where required to meet waterproofing requirements. See manufacturer data sheet for installation and additional information.

2.04 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Engineer and Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.
- B. Except as otherwise specified, submit written reports to Architect and Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect and Engineer.
- C. Unless lower limits are stated in the contract documents, all concrete exposed to freezing and thawing in moist condition and/or required to be watertight or used in slabs-on-grade shall have a maximum W/cm ratio of 0.45.
- D. Provide concrete of following strength:
 - 1. Compressive strength (28 day) shall be as shown on Structural Drawings.
 - 2. Select proportions for normal weight concrete in accordance with ACI 301 by Method 1, 2 or 3 as applicable. Add air-entraining agent to concrete to entrain air as indicated in ACI 301.
- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, water, test results, or other circumstances warrant; at no

additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by architect before using in work.

F. Admixtures:

1. Use water-reducing admixture or high-range, water-reducing admixture (super plasticizer), may be used in concrete subject to approval by Architect.
2. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F (10 degrees C).
3. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content of 4 percent to 6 percent.

2.05 CONCRETE MIXES

- A. Ready-Mix Concrete: All concrete shall be ready-mix concrete unless otherwise approved by the Engineer and Architect.
- B. Self-Leveling Concrete Topping - Underlayment for Interior Applications:
1. Topping for epoxy terrazzo flooring application shall include latex modifier, such as "TERA-GEM III, Revocoat Latex #1 Additive". Follow manufacturer's recommendations and flooring installation requirements.
 2. Use self-leveling underlayment concrete formulated to level concrete floors without shrinking, cracking or spalling, and capable of being placed from feathered edge to 1" thickness without aggregate in one pour. If greater than 1" thickness is required, aggregate shall be used in accordance with manufacturer's requirements. Appropriate primer shall be utilized for all underlayment applications.
 3. Example acceptable product: Ardex Engineered Cements "ARDEX K-15"
 4. Example acceptable product: Euclid Chemical's "Flo-Top or Super Flo-Top"
 5. Example acceptable product: Sika Corporation "Sika Level Series"
 6. Example acceptable product: BASF "MasterTop 110SL"

PART 3 - EXECUTION

3.01 PLACING CONCRETE

- A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
- B. Place concrete in accordance with ACI 304, and as herein specified.
- C. Notify Structural Engineer minimum 48 hours prior to placing of concrete.
- D. Ensure anchors, seats, plates, and other items to be cast into concrete are placed, held securely, and will not cause problems in placing concrete. Rectify misplacements and proceed with work.
- E. Maintain records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.
- F. Ensure reinforcement, embedded parts, formed expansion and contraction joints, and other inserts are not disturbed during concrete placement.
- G. Prepare previously placed concrete by blowing joints and provide keyway.

- H. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified only with prior approval of the Architect. Deposit concrete as nearly as practicable to this final location to avoid aggregation.
- I. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- J. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
- K. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators 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 set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- L. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- M. Bring slab surfaces to correct level with straight-edge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- N. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer and Architect immediately on discovery.
- O. Conform to ACI 305 when concreting during hot weather.
- P. Conform to ACI 306 when concreting during cold weather.
- Q. Unless otherwise permitted, time for completion of discharge shall comply with ASTM C94/C94M. When discharge is permitted after more than 90 minutes have elapsed since batching or after the drum has revolved 300 revolutions, verify that air content of air-entrained concrete, slump, and temperature of concrete are as specified. When discharge is permitted after more than 90 minutes have elapsed since batching or after the drum has revolved 300 revolutions, no water may be added.

3.02 FINISH OF FORMED SURFACES

- A. Rough Form Finish: For all formed concrete surfaces except as noted below. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projects exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaced exposed-to-view or to be covered with a material such as waterproofing that requires a smooth surface. This is as cast arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas, with fins or other projects completely removed and smoothed.

3.03 MONOLITHIC SLAB FINISHES

- A. General: finish slab surfaces in accordance with one of the finishes noted below, as designated in the Contract Documents. Finish all joints and edges with proper tools as approved.
- B. Placement: Place concrete at rate that allows spreading, straight-edging, and darbying or bull floating before bleed water appears. Screed all slabs, topping fills to true levels and slopes. Work surfaces as required to produce specified finish. Do no finishing in areas where water has accumulated; drain and re-screed. In no case use a sprinkling of cement and sand to absorb moisture.
- C. Tolerances: Measure slabs-on-grade to verify compliance with the tolerance requirements of ASTM E 1155 and ACI 117. Measure floor finish tolerances within 72 hours after slab finishing and before removed of supporting formwork or shoring.
 - 1. Concrete slab flatness and levelness tolerances to meet ACI 117, Section 4.5.6.
 - a. Minimum requirements at slab-on-ground: Flatness overall min Ff = 20 and levelness overall min Fl = 17.
- D. Scratch Finish:
 - 1. Apply scratch finish to monolithic slab surfaces that are to receive mortar setting beds for tile, where mortar set tile is indicated on drawings.
 - 2. After placing slabs, plane surface to a tolerance not exceeding $\frac{1}{4}$ " in 10' when tested with a 10' straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with staff brushes, brooms, or rakes.
- E. Float Finish:
 - 1. Apply float finish to monolithic slab surfaces scheduled to receive trowel finish and other finishes as hereinafter specified.
 - 2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding $\frac{1}{4}$ " in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float surfaces to a uniform, smooth, granular texture.
- F. Trowel Finish:
 - 1. Unless otherwise noted, apply trowel finish to monolithic slab surfaces to be left exposed-to-view, or scheduled to receive floor finishes other than setting bed types.
 - 2. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding those called out above in section C. Grind smooth surface defects, which would telegraph through applied floor covering system.
- G. Non-Slip Broom Finish:
 - 1. Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
 - 2. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.04 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Start curing procedures as soon as free water has disappeared from concrete surface after placing and finishing.
 - 2. Continue curing as directed by Architect and in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- B. Curing Methods: Perform curing of concrete by either moist curing, by moisture retaining cover curing, membrane curing, or by combinations thereof, as herein specified.
 - 1. Provide moisture curing by following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.
 - 2. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed at widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Provide liquid membrane curing as follows:
 - a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as possible after final finishing operations are complete, but not later than 2 hours. Apply uniformly in a continuous operation by power spray equipment or roller equipment in accordance with the manufacturer's directions. Recoat areas that are subjected to heavy rainfall within three hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.
 - b. Verify compatibility of membrane curing compounds on surfaces that are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the Architect.
 - c. Do not use curing compounds that will diminish bond of subsequent materials.
 - 4. Curing Formed surfaces: Cure formed concrete surfaces, including walls with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
 - 5. Curing Unformed surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by any of the methods specified herein, as applicable.

3.05 PATCHING

- A. Allow Architect/Structural Engineer to inspect concrete surfaces immediately upon removal of forms. Patch imperfections as directed.

3.06 FIELD QUALITY CONTROL

- A. Contractors Testing Laboratory: As specified in Article 1.03 above.

3.07 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required lines, details, and elevations.

- B. Repair or replace concrete not properly placed resulting in excessive honeycombing and other defects. Patch, fill, touch up, repair, or replace exposed architectural concrete for each individual area in accordance with Architect's particular directions.

END OF SECTION

SECTION 03 33 00**ARCHITECTURAL CONCRETE****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Cast-in-place architectural concrete, including formwork, reinforcement accessories, concrete materials, concrete mix design, placement procedures, and finishes.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 03 35 00 - Concrete Finishing: For concrete finishes.

1.02 REFERENCES

- A. AASHTO - American Association of State Highway and Transportation Officials
- B. ACI - American Concrete Institute
 - 1. 117 - Specifications for Tolerances for Concrete Construction and Materials and Commentary.
 - 2. 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 - 3. 301 - Specifications for Structural Concrete for Buildings.
 - 4. 303.1 - Standard Specification for Cast-in-Place Architectural Concrete.
- C. ASTM - American Society for Testing and Materials
 - 1. C33 - Standard Specification for Concrete Aggregates.
 - 2. C94 - Standard Specification for Ready-Mixed Concrete.
 - 3. C150 - Standard Specification for Portland Cement.
 - 4. C171 - Standard Specification for Sheet Materials for Curing Concrete.
 - 5. C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 6. C494 - Standard Specification for Chemical Admixtures for Concrete.
 - 7. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - 8. C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

1.03 DEFINITION

- A. Architectural Concrete: Concrete that is exposed to view on surfaces of the completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.

1.04 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Quality Assurance Submittals
 - 1. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

2. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated, based on comprehensive testing of current materials.
3. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - a. Cementitious materials and aggregates.
 - b. Admixtures.
 - c. Curing compounds.
4. Placement Schedule: Submit concrete placement schedule before start of architectural concrete placement operations. Include location of all joints including construction joints.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced architectural concrete contractor who has specialized in installing architectural concrete 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.
- B. ACI Standards: Comply with ACI 303.1, ACI 301, and ACI 117, unless more stringent provisions are indicated.
- C. Mockups: Provide mockups for Architect's approval prior to start of final unit work as specified in Section 03 35 00.

PART 2 - PRODUCTS

2.01 FORMWORK AND REINFORCEMENT ACCESSORIES

- A. General: Comply with Structural Drawings for formwork, steel reinforcement, and other requirements for reinforcement accessories.

2.02 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I, of same type, brand, and source for entire Project.
 1. Fly Ash: ASTM C618, Class C or F; provide minimum 20 percent content.
 2. Normal-Weight Coarse Aggregate: ASTM C33, from the same source for entire Project, and as follows:
 - a. Weathering Region and Class: Negligible, 1N.
 - b. Nominal Maximum Aggregate Size: 3/8-inch.
 - c. Gradation: Uniformly graded.
 3. Normal-Weight Fine Aggregate: ASTM C33, manufactured or natural sand, from the same source for entire Project.
 4. Water: Potable, complying with ASTM C94 except free of wash water from mixer washout operations.
 5. Chemical Admixtures: Certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
 - a. Air-Entraining Admixture: ASTM C260.
 - b. Water-Reducing Admixture: ASTM C494, Type A.
 - c. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.

2.03 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, washed to prevent concrete staining, weighing approximately 9 oz./sq. yd. when dry.
 - 1. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

2.04 REPAIR MATERIALS

- A. Epoxy Bonding Adhesive: ASTM C881, 2 component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 - 2. Refer to Structural Drawings for additional product specifications.

2.05 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of architectural concrete determined by either laboratory trial mix or field test data bases. Proportion concrete according to ACI 211.1 and ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mix designs for the laboratory trial mix basis.
 - 2. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in architectural concrete at point of placement having an air content of 2 to 4 percent.

2.06 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver architectural concrete according to ASTM C94, and furnish batch ticket information.

PART 3 - EXECUTION**3.01 FORMWORK**

- A. General: Comply with Structural Drawings for formwork, embedded items, shoring, reshoring, and additional requirements.

3.02 REINFORCEMENT AND INSERTS

- A. General: Comply with Structural Drawings for fabricating and installing steel reinforcement and for additional requirements.

3.03 JOINTS

- A. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Architect and the Structural Engineer.
- B. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.04 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

- B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by the Architect.
- C. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.

3.05 FINISHES, GENERAL

- A. General: Comply with Section 03 35 00 for concrete finishes.

3.06 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures according to ACI 301.
 - 1. Do not place concrete when temperature is below 40 degrees Fahrenheit unless approved by the Architect. The Contractor shall provide means for preventing damage from freezing before and after placement.
- B. Begin curing immediately after removing forms from concrete. Cure by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
 - 1. Moisture Curing: Keep exposed surfaces of architectural concrete continuously moist for not less than 7 days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12 inch lap over adjacent absorptive covers.
 - d. 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 7 days. Immediately repair any holes or tears during curing period; use cover material and waterproof tape.
 - e. Curing Compound: Mist concrete surfaces with water. Apply curing compound 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.

3.07 REPAIRS, PROTECTION, AND CLEANING

- A. Repair and cure damaged finished surfaces of architectural concrete when approved by the Architect. Match repairs to color, texture, and uniformity of surrounding surfaces.
 - 1. Remove and replace architectural concrete that cannot be repaired and cured to the Architect's approval.
 - 2. Protect corners, edges, and surfaces of architectural concrete from damage; use guards and barricades.
 - 3. Protect architectural concrete from staining, laitance, and contamination during remainder of construction period.
 - 4. Clean architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.
 - 5. Wash and rinse surfaces according to concrete finish applicator's written recommendations. Protect other Work from staining or damage due to cleaning operations.
 - 6. Do not use cleaning materials or processes that could change the appearance of architectural concrete finishes.

END OF SECTION

SECTION 03 35 00**CONCRETE FINISHING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Concrete finishes, including board forms.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 03 10 00 - Concrete Formwork: Provision of concrete formwork.
 - 2. Section 03 20 00 - Concrete Reinforcement: Provision of concrete reinforcement.
 - 3. Section 03 30 00 - Cast-In-Place Concrete: Provision of cast-in-place concrete.
 - 4. Section 03 33 00 - Architectural Concrete: Provision of architectural concrete.
 - 5. Section 03 54 16 - Hydraulic Cement Underlayment: Provision of underlayment at flooring installations.

1.02 REFERENCES

- A. ACI - American Concrete Institute
 - 1. 347 - Recommended Practice for Concrete Formwork.
- B. ASTM - American Society for Testing and Materials
 - 1. E1155 - Standard Test Method for Determining F/F Floor Flatness and F/L Floor Levelness Numbers.

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements
 - 1. Provide smooth formed concrete surfaces where indicated on the Drawings, utilizing steel, fiberglass, or plastic coated forms or any other kind of material that will impart no pattern to concrete where indicated on the Drawings.
 - 2. Provide board-formed concrete surfaces where indicated on the Drawings.
 - 3. Pour joints of cast-in-place concrete shall align with reveals, rustication joints and/or control joints as indicated on the Drawings.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for specified products.
- B. Shop Drawings: Submit shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
 - 1. The Architect's review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is the Contractor's responsibility.
- C. Samples
 - 1. Submit samples of form liners, including names, sources and descriptions.
 - 2. Submit 12 inches by 12 inches minimum size, duplicate concrete panels for selection and approval of finish.

1.05 QUALITY ASSURANCE

- A. Mockups: 24 inches by 24 inches shotcrete panel to demonstrate surface finish.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Concrete Formwork: As specified in Section 03 10 00.
 - 1. Board-Formed Finished Concrete: Provide lumber dressed on at least 2 edges and 1 side for tight fit.
 - a. Lumber Species and Sizes: As selected by the Architect.
- B. Concrete Reinforcing: As specified in Section 03 20 00.
- C. Cast-In-Place Concrete: As specified in Section 03 30 00.
- D. Sealer: Penetrating transparent, as manufactured by L. M. Scofield; Master Builders, Inc., or approved equal.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrate and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting application of sealer finish.
- B. Do not proceed with application until unsatisfactory conditions have been corrected.

3.02 FORMWORK

- A. General: Design, erect, support, brace and maintain formwork to support vertical, lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:
 - 1. Provide Class A tolerances for concrete surfaces exposed to view.
 - 2. Provide Class C tolerances for other concrete surfaces.
- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

- E. Square exposed corners and edges as indicated on the Architectural Drawings, using wood, metal, PVC, or rubber strips fabricated to produce uniform smooth lines and tight edge joints.
- F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- H. Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- I. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
- J. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.
- K. At construction joints, overlap and clamp forms, using gaskets if necessary, to prevent offsets or loss of mortar at joints.
- L. Refer to Section 03 10 00 for additional formwork requirements.

3.03 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by stock form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.
- B. Smooth-Formed Finish: Unless otherwise indicated to have board-formed finish, provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of joints. Grout tie holes; remove and rub smooth fins or other projections. Surfaces remaining exposed-to-view shall have uniform color and texture acceptable to the Architect.
- C. 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.

3.04 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, pavers and other bonded applied cementitious finish flooring material, and where indicated.

1. After placing slabs, finish surface to tolerance not exceeding 1/2-inch in 10 feet when tested with a 10 feet straight edge, or to tolerance of F(F) not less than 15 (floor flatness) and F(L) not less than 13 (floor levelness) measured according to ASTM E1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or as otherwise indicated.
 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 5/16-inch in 10 feet when tested with a 10 feet straightedge or to tolerance of F(F) not less than 20 (floor flatness) and F(L) not less than 15 (floor levelness) measured according to ASTM E1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply a smooth steel trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, wood flooring assemblies, carpet, thin set ceramic or paver, paint or another thin film finish coating system.
 1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 3/16-inch in 10 feet when tested with a 10 feet straightedge or to tolerances of not less than F(F) 30 (floor flatness) and F(L) not less than 20 (floor levelness) measured according to ASTM E1155. Grind smooth any surface defects that would telegraph through applied floor covering system.
 - a. Trowel and Fine Broom Finish: Where ceramic or paver tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
 - b. Light Broom Finish: Apply a light broom finish to pedestrian areas within the parking garage as indicated and at stair steps and landings. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with the Architect before application.
- D. Control joints in slab shall be saw cut where indicated. Use 1/8-inch wide diamond concrete blade, made by Soff-Cut XL6-3000, or approved equal.
- E. Refer to Section 03 30 00 for additional concrete finishing and curing requirements.

3.05 CONCRETE SURFACE REPAIRS

- A. Intent of this Specification is to require forms, mixtures of concrete and workmanship so that concrete surfaces will require no patching.
- B. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to the Architect.
- C. Mix dry-pack mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

1. Cut out honeycombs, rock pockets, voids over 1/4-inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas 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.
- D. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- E. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01-inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 3. Correct low areas in unformed surfaces 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. Proprietary underlayment compounds may be used when acceptable to the Architect.
 4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- F. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- G. Perform structural repairs as indicated in Section 03 30 00.
- H. Repair methods not specified above may be used, subject to acceptance of the Architect.

3.06 SEALED CONCRETE

- A. Clean concrete surface contaminated with dirt, oil, bond breakers or other contaminants that could interfere with bonding.
- B. Use acid wash to remove previously applied coating or contaminant or lightly sand or lightly sandblast concrete prior to sealing.
 - 1. If acid wash is used, thoroughly rinse the surface to remove any residual acid or salts before application of sealer.
- C. Test at least 8 square feet of surface to determine acceptability of dry film appearance and adhesion. Failure to test will void the Warranty.
- D. Apply sealer in accordance with manufacturer's instructions.
- E. Protect finish as required.

3.07 PROTECTION

- A. Restore finishes damaged during installation and construction so that no evidence remains of correction work.

END OF SECTION

SECTION 03 37 13

SHOTCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Section Includes: Sprayed-on concrete (concrete conveyed into place by air pressure through a flexible tube or gun with controlled nozzle) referred to herein as Shotcrete.
- B. Related Sections:
 - 1. Section 03 10 00 – Concrete Forming and Accessories.
 - 2. Section 03 20 00 - Concrete Reinforcing.
 - 3. Section 03 30 00 - Cast-In-Place Concrete.
 - 4. Section 03 35 00 – Concrete Finishing.

1.02 REFERENCES

- A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specifications, standards, test, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply unless otherwise noted).
 - 1. California Code of Regulations, Title 24, Part 2, also known as the California Building Code (CBC), 2022 Edition.
 - 2. American Society for Testing and Materials (ASTM).
 - 3. American Concrete Institute's "Specifications for Structural Concrete for Buildings" (ACI 301).
 - 4. American Concrete Institute: "Guide to Shotcrete" (ACI 506R), "Specification for Shotcrete," (ACI 506.2) and "Guide to Certification of Shotcrete Nozzlemen" (ACI 506.3R).
 - 5. State of California, Business and Transportation Agency, Division of Highways' "Materials Manual," (CMM).

1.03 QUALITY ASSURANCE

- A. The Contractor shall select and pay for a testing laboratory, called the Contractor's Testing Laboratory, to design concrete mixes. The Contractor's Testing Laboratory shall be under direction of a Civil Engineer registered in the

State of California, shall have operated successfully for four years prior to this work, and shall conform to requirements of ASTM E329.

- B. Design Criteria: Shotcrete surface texture shall be uniform, dense, free from defects, and visible construction joints. Any portions showing cracks, damage, lack of uniformity in color or texture shall be replaced by the Contractor at no increase in contract price. All work shall be performed in a manner to conform with highest standard of practice and in accordance with recommendations of ACI 506R.
- C. The Contractor shall be responsible for quality of Shotcrete and shall bear burden of proof that Shotcrete meets minimum requirements.

1.04 SUBMITTALS

- A. The Contractor's Testing Laboratory certificate of compliance.
- B. The Contractor shall submit:
 - 1. Copies of Shotcrete mix designs for concrete specified including compressive strength reports.
 - 2. Certification that materials meet requirements specified.
 - 3. Certification from vendor that samples originate from and are representative of each lot proposed and used.
- C. The Owner's Testing Agency will submit reports on tests and inspections performed to the Owner, the Architect, the Contractor, the Project Inspector and the building department.
- D. Schedule of placing for the Architect's review before starting work.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Properly deliver and handle materials to prevent contamination, segregation, or damage to materials.
- B. Store cement in weathertight enclosures to protect against dampness and contamination.
- C. Prevent segregation and contamination of aggregates by proper arrangement and use of stockpiles.
- D. Store admixtures properly to prevent contamination, evaporation, freezing, or other damage.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Conform to ACI 506.2 and CBC Section 1913A.1.

- B. Cements: Type II Portland cement (by one manufacturer only) conforming to ASTM C150.
- C. Aggregates: Conforming to ASTM C33 and ACI 506.2 Gradation No. 2 and CBC Sections 1903A.3 and 1913A.3. Provide fine aggregate as required to achieve a smooth, exposed architectural quality surface, limit air bubbles, and other surface defects limited to 1/4 inch.
- D. Water: Clean and conforming to the requirements of ASTM C94, free from impurities detrimental to concrete.
- E. Admixtures: Conform to ASTM C494.
- F. See Specifications Section 03 30 00 Part 2 for requirements not otherwise noted in this section.

2.02 MIXES

- A. The Contractor's Testing Laboratory shall design Shotcrete mixes which shall comply with ACI 506R and 506.2 and achieve 4000 psi compressive strength in 28-days.
- B. The Contractor shall instruct Testing Laboratory to base mix designs on use of materials tested and approved by the Owner's Testing Agency.
- C. Ensure mix designs will produce concrete strengths specified and of uniform density without segregation. If mix yield exceeds 1-cubic yard, modify mix design to no more than 1-cubic yard without changing cement content.
- D. The Contractor's mix designs shall be subject to review by the Architect and by the Owner's Testing Agency. The Owner's Testing Agency will base its acceptance on the Contractor's materials as tested and approved.
- E. Owner's Testing Agency will obtain core specimens from test panels generated from nozzle persons prequalification for compression strength testing and correlation.
- F. Shotcrete mix designs shall be designed, tested, and adjusted if necessary in ample time before first Shotcrete is scheduled to be placed.
- G. Ensure mix designs will produce smooth architectural quality finish surface. Do not allow bug holes, air bubbles or other surface defects to form.

2.03 SOURCE QUALITY CONTROL

- A. The Owner's Testing Agency will:
 - 1. Review mix designs, certificates of compliance, and samples of materials the Contractor proposes to use.

2. Test and inspect materials, as necessary, in accordance with ACI 318 and ACI 506.2, CBC Sections 1916A.6, 1704A.15 and 1704A.15.1 for compliance with requirements.
3. Take samples as required from the Contractor's designated sources.
4. Take one sample for each 100 tons of Portland cement except that, when used in bulk loading ready-mix plants where separated bins for pretested cement are not available, take grab samples for each shipment of cement placed in bin with not less than one sample being taken for each day's pour and subsequently test such samples if required by the Architect.
5. Test fine aggregate by use of solution of sodium or magnesium sulfate, or both whenever in the judgement of the Architect such tests are necessary to determine quality of material. Perform such tests in accordance with ASTM C88. Loss shall not exceed 6-percent. Aggregate failing to comply with this requirement may be used in the Work provided it contains less than 2-percent of shale and other deleterious particles and shows a loss in soundness test of not more than 10-percent when tested in the sodium sulphate solution.
6. Test for sand equivalent of fine aggregate in accordance with California Test 217.
7. Inspect batch plant method if Shotcrete is ready-mixed or site equipment if field mixed prior to any work to verify following:
 - a. Plant or site is equipped with moisture meter for accurately determining moisture content of fine aggregate.
 - b. Other plant or site quality controls are adequate.
8. Inspect quality and quantity of materials used in batched aggregates and ready-mix concrete at mixing plant or on-site if field-mixed.

PART 3 - EXECUTION

3.01 FORMS

- A. Forms and ground wires for Shotcrete shall comply with CBC Section 1913A.12.
- B. Concrete surfaces to receive Shotcrete shall be prepared in accordance with CBC Section 1913A.1.

3.02 BATCHING AND MIXING

- A. Mix proportions shall be controlled by weight batching to exact proportions of Shotcrete mix designs.
- B. Ready-mixed concrete shall comply with ASTM C94, except that it may be delivered to the Shotcrete equipment in the dry state if that equipment is capable

of adding the water and mixing it satisfactorily with the dry ingredients. Ensure equipment at plant or on-site will afford accurate weighing.

- C. Replace at no additional expense, equipment the Architect and the Owner's Testing Agency deem inadequate or unsuitable.
- D. Use moisture meter capable of accurately determining moisture content of sand.

3.03 PLACING

- A. Where Shotcrete is to be placed up against waterproofing, do not install reinforcement until bentonite waterproofing has been reviewed by the Architect and accepted by the Owner's Testing Agency.
- B. Do not place Shotcrete until reinforcement has been reviewed by the Architect and accepted by the Owner's Testing Agency.
- C. Place Shotcrete following procedures specified in ACI 506R and CBC Section 1913A.13. Convey Shotcrete as rapidly and directly as practicable to preserve quality and to prevent separation from re-handling and flowing; do not deposit Shotcrete initially set. If mixed at a ready-mixed plant, place Shotcrete into pump within forty-five (45) minutes after mixing.
- D. Placement Techniques:
 - 1. Control thickness, method of support, air pressure, and/or water content of Shotcrete to preclude sagging or sloughing off. Discontinue shotcreting or provide suitable means to screen the nozzle stream if wind or air currents cause segregation of the nozzle stream during placement.
 - 2. Dampen absorptive substrate surfaces prior to placement of Shotcrete to facilitate bond and to reduce the possibility of shrinkage cracking developing from premature loss of the mixing water.
 - 3. Broom or scarify the surface of freshly-placed Shotcrete to which, after hardening, additional layers of Shotcrete are to be bonded. Dampen surface just prior to application of succeeding layers.
 - 4. First, fill with sound material all corners and any area where rebound cannot escape or be blown free. Then, complete the corners between the web and the flanges of structural steel before application to the flat areas.
 - 5. Provide a supply of clean, dry air adequate for maintaining sufficient nozzle velocity for all parts of the work and, if required, for simultaneous operation of a suitable blow pipe for clearing away rebound.
- E. Placement around Reinforcement:

1. Hold the nozzle at such distance and angle to place materials behind reinforcement before any material is allowed to accumulate on its face.
 2. Do not place Shotcrete through more than one layer of reinforcing steel in one application unless demonstrated by preconstruction tests that steel is properly encased. Remove loose aggregate that may have collected around or behind reinforcement by use of air jet or other suitable means.
- F. Cover and Tolerances:
1. Place Shotcrete to provide minimum cover shown on contract drawings.
 2. Use adequate wires or other accepted means to establish the thickness, surface planes, and finish lines of Shotcrete. Maintain tolerances by keeping ground wires secured taut.
- G. Do not place Shotcrete if drying or stiffening of the mix takes place at any time prior to delivery to the nozzle. Do not use rebound or previously expended material in the Shotcrete mix.
- H. Remove all overspray or rebound prior to final set and before placement of Shotcrete material on such adjacent surfaces.

3.04 JOINTS

- A. Provide non-tapered joints with keyed configurations per Contract Documents. Avoid trapping rebound in joint. Joints shall be cleaned and wetted prior to the application of additional concrete. Comply with CBC Section 1913A.7.

3.05 FINISHING

- A. Do not scrape or cut to remove high spots until the Shotcrete has become stiff enough to withstand pull of the cutting device.
- B. Following Shotcrete application to final lines, rod surface.
- C. Following moist curing, apply plaster sand finish.
- D. See related Section 03 35 00 for more information.

3.06 CLEANING, PATCHING AND DEFECTIVE WORK

- A. Remove and replace Shotcrete which lacks uniformity, exhibits segregation, honeycombing, or lamination, or which contains any dry patches, slugs, voids, or sand pockets. Remove and replace damaged in-place Shotcrete in accordance with CBC Section 1913A.8.
- B. Chip or scarify any area to be repaired to remove offsets which would cause an abrupt change in thickness without suitable reinforcement. Taper edges to leave no square shoulders at the perimeter of a cavity. Remove all loose material from areas receiving Shotcrete. Wet the surface until it is damp, but without visible free water.

- C. Repair core holes in accordance with ACI 301. Do not fill core holes with Shotcrete.
- D. Clean up and dispose of rebound or accumulated loose material.
- E. Repair all defective work to achieve smooth finish surface as directed by the Architect of Record. Surface condition shall be approved by the Architect of Record.

3.07 CURING

- A. Immediately after finishing, keep Shotcrete continuously moist for at least 24-hours. Comply with CBC Section 1913A.9.
- B. Continue curing for the first 7-days after shotcreting, or until specified strength is obtained. During the curing period, maintain Shotcrete above 40 F and in a moist condition. Prevent rapid drying at the end of the curing period.

3.08 PROTECTION

- A. Protect concrete from injurious action of the elements and defacement of any nature during construction operations.
- B. Protect exposed corners of concrete from traffic or use which will damage them in any way.
- C. Make provisions to keep all exposed concrete free from laitance caused by spillage or leaking forms or other contaminants. Do not allow laitances to penetrate, stain, or harden on surfaces which have been textured.

3.09 QUALITY ASSURANCE

- A. The Owner's Testing Agency will:
 - 1. Perform testing in accordance with ACI 506.2 and CBC Section 1916A.6.
 - 2. Continuously inspect Shotcrete placement in accordance with CBC Sections 1704A.15 and 1704A.15.1.
- B. The Contractor shall:
 - 1. If Shotcrete is ready-mixed, submit ticket for each batch of concrete delivered to job site. Ticket shall bear the following information in addition to the minimum data required by ASTM C94 Section. 13.1).
 - a. Design mix number of the Contractor's Testing Agency.
 - b. Signature or initials of ready mix representative.
 - c. Type, brand and amount of admixture.

- d. Weight of cement and aggregates, including maximum aggregate size in each batch.
 - e. Information necessary to calculate the total mixing water added by the producer (including aggregate moisture, water added during batching and by the truck operator).
2. Pay the Owner's Testing Agency for taking additional core specimens of hardened structure and testing specimen according to ASTM C42 when initial core tests show compressive strengths below specified minimum.

END OF SECTION

SECTION 03 54 16**HYDRAULIC CEMENT UNDERLAYMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Self-leveling underlayment that consists of a blend of portland cements, other hydraulic cements, and polymers that is used to level and smooth interior concrete prior to the installation of finished flooring.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 03 30 00 - Cast-In-Place Concrete: Provision of cast-in-place concrete.
 - 2. Section 03 35 00 - Concrete Finishing: Provision of concrete finishes.
 - 3. Section 09 30 00 - Tiling: Provision of ceramic tile.
 - 4. Section 09 65 00 - Resilient Flooring: Provision of resilient flooring.
 - 5. Section 09 68 13 - Tile Carpeting: Provision of tile carpeting.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens).
 - 2. C150 - Standard Specification for Portland Cement.
 - 3. C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
 - 4. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 5. F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- B. RFCI - Resilient Floor Covering Institute

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements
 - 1. Provide smooth formed concrete surfaces where indicated on the Drawings, utilizing steel, fiberglass, or plastic coated forms or any other kind of material that will impart no pattern to concrete where indicated on the Drawings.
 - 2. Pour joints of cast-in-place concrete shall align with reveals, rustication joints and/or control joints as indicated on the Drawings.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used. Include manufacturer's Material Safety Data Sheets.
- B. Qualification Data: For Installer.

1.05 QUALITY ASSURANCE

- A. Installation of the underlayment shall be completed by a factory-trained applicator, using mixing equipment and tools approved by the manufacturer. Contact ARDEX Americas (724) 203-5000 for a list of recommended installers.
- B. Product shall have hydraulic cement-based inorganic binder content as the primary binder which includes portland cement per ASTM C150 and other specialty hydraulic cements. Gypsum-based products are not acceptable.
- C. Manufacturer Experience: Provide products of this Section by companies which have successfully specialized in production of this type of product for not less than 10 years. Contact Manufacturer Representative prior to installation.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number, and shelf life.
- B. Store products in a dry area with temperature maintained between 50 degrees and 85 degrees Fahrenheit and protect from direct sunlight.
- C. Handle products in accordance with manufacturer's printed recommendations.

1.07 PROJECT CONDITIONS

- A. Do not install material below 50 degrees Fahrenheit surface and air temperatures. These temperatures shall be maintained during and for 48 hours after the installation of products included in this Section. Install quickly if substrate is warm and follow warm weather instructions available from the manufacturer.

1.08 WARRANTY

- A. Underlayment manufacturer provides a 5-year limited warranty when underlayment is installed as part of a floor system with installation materials as recommended by the underlayment manufacturer.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Hydraulic Cement-Based Self-Leveling Underlayment
 - 1. Performance and Physical Properties: Meet or exceed the following values for material cured at 73 degrees Fahrenheit plus/minus 3 degrees Fahrenheit and 50 percent plus/minus 5 percent relative humidity:
 - a. Application: Barrel mix or pump.
 - b. Flow Time: 10 minutes.
 - c. Final Set: Approx. 90 minutes.
 - d. Compressive Strength: 4500 psi at 28 days, ASTM C109.
 - e. Flexural Strength: 1000 psi at 28 days, ASTM C348.
 - f. VOC: 0.
 - 2. Product: As manufactured by ARDEX Americas, "ARDEX V 1200", or approved equal.

- B. Primer: Solvent-free, concentrated primer dilutes with water, for interior use, 0 g/L VOC.
 - 1. Product: As manufactured by ARDEX Americas, "ARDEX P 51", or approved equal.
- C. Water: Shall be clean, potable, and sufficiently cool (not warmer than 70 degrees Fahrenheit).
- D. Patching Compound at Concrete Masonry Units: Concrete resurfacing compound modified with high-performance polymers for exceptional bond strength; formulated from a blend of portland cement and other hydraulic cements; can be used over the surface of existing concrete to produce a new wear layer as well as to fill in small surface defects, such as spalls and gouges.
 - 1. Product: As manufactured by ARDEX Americas, "ARDEX CD", or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

- A. General: Prepare substrate in accordance with manufacturer's instructions.
 - 1. Concrete
 - a. Prior to proceeding, please refer to ASTM F710. All concrete subfloors shall be sound, solid, clean, and free of all oil, grease, dirt, certain curing compounds, and any contaminant that might act as a bond breaker before priming. Mechanically clean, if necessary, using shot blasting or other. Acid etching and the use of sweeping compounds and solvents are not acceptable.
 - b. Substrates shall be inspected in accordance with ASTM F2170 and corrected for moisture or any other conditions that could affect the performance of the underlayment or the finished floor covering. For areas where moisture vapor emissions exceed the required limits, install the appropriate moisture control system.
 - 2. Crack and Joint Preparation
 - a. Moving Joints and Moving Cracks: Honor all moving joints and moving cracks up through the underlayment. A flexible sealing compound such as ARDEX ARDISEAL™ Rapid Plus Semi-Rigid Joint Sealant may be installed.
 - b. Saw Cuts, Control Joints, and Dormant Cracks: Fill all dormant joints and dormant cracks with ARDEX ARDIFIX™ Low Viscosity Rigid Polyurethane Crack & Joint Repair or ARDEX FEATHER FINISH® Self-Drying, CementBased Finish Underlayment as recommended by the manufacturer.
 - 3. Adhesive residues on concrete must first be tested to make certain they are not watersoluble. Water-soluble adhesives shall be completely mechanically removed down to clean concrete. Non-water-soluble adhesives shall be prepared to a thin, well-bonded residue using the wet-scraping technique as recommended by the RFCI (www.rfci.com). The prepared residue shall appear as nothing more than a transparent stain on the concrete after scraping.
 - 4. Other Non-Porous Substrates: The substrate shall be clean and free of all waxes, sealers dust, dirt, debris, and any other contaminant that may act as a bond breaker. If necessary, clean by mechanical methods such as shot blasting.

3.02 APPLICATION OF UNDERLAYMENT

- A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas from contact due to mixing and handling of materials.
- C. Priming: Comply with manufacturer's printed instructions.

- D. Mixing: Comply with manufacturer's printed instructions and the following.
1. Add 5 quarts of clean potable water per 50 lb. bag.
 2. Mix using a 1/2-inch (minimum 650 rpm) heavy-duty mixing drill with an ARDEX T-1 mixing paddle. Do not overwater.
 3. For pump installations, ARDEX V 1200™ shall be mixed using the ARDEX ARDIFLO™ Automatic Mixing Pumps. Contact the ARDEX Technical Service Department (888) 512-7339 for complete pump operation instructions.
- E. Application: Comply with manufacturer's printed instructions and the following.
1. Underlayment shall be installed at a minimum thickness of 1/8-inch over the highest point in the floor, which typically results in an average thickness of 1/4-inch or more over the entire floor. Underlayment can be installed up to 1-1/4 inches thick and can also be tapered to as thin an application as the sand will allow to match existing elevations. If a true featheredge is needed, ARDEX recommends using ARDEX FEATHER FINISH® for transitions.
 2. Pour the liquid underlayment and spread in place with the ARDEX T-4 Spreader. Immediately use the ARDEX T-5 Smoother or T-6 Spike Roller to smooth the surface. Wear non-metallic cleats to avoid leaving marks in the liquid ARDEX V 1200™.
- F. Curing: Underlayment can be walked on in 2-3 hours after installation. The cure time required prior to installing finish flooring will vary with the thickness of the ARDEX V 1200 installation and the type of flooring being installed. Contact ARDEX Technical Services Department (888) 512-7339 for information regarding recommended cure times.
- G. Where specified, field sampling of the underlayment is to be done by taking an entire unopened bag of the product being installed to an independent testing facility to perform compressive strength testing in accordance with ASTM C109/modified: air-cure only. There are no in situ test procedures for the evaluation of compressive strength.

3.03 PROTECTION

- A. Prior to the installation of the finish flooring, the surface of the underlayment shall be protected from abuse by other trades by the use of plywood, Masonite, or other suitable protection course.

END OF SECTION

SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section Includes: Provision of concrete masonry work, including but not limited to, masonry units, mortar, grout, reinforcing steel, control joints, testing and inspection.
- B. Related Sections:
 - 1. Section 03 20 00 – Concrete Reinforcing.
 - 2. Section 03 30 00 – Cast-in-Place Concrete.
 - 3. Section 05 12 00 – Structural Steel Framing.
 - 4. Section 07180 – Water Repellant Coatings.

1.2 REFERENCES

- A. Requirements of the GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this Section where cited by abbreviations noted below (latest editions apply).
 - 1. California Building Code (CBC), 2022 Edition.
 - 2. American Concrete Institute (ACI):
 - a) “Building Code Requirements for Masonry Structures,” ACI 530-08 / ASCE 5-08 / TMS 402-08 (ACI 530).
 - b) “Specifications for Masonry Structures,” ACI 530.1-08 / ASCE 6-08 / TMS 602-08 (ACI 530.1).
 - c) “Manual of Standard Practice for Detailing Reinforced Concrete Structures” (ACI 315).
 - 3. American Society for Testing and Materials (ASTM).
 - a) “Specification for Quicklime for Structural Purposes” (ASTM C5).
 - b) “Specification for Load Bearing Masonry Units” (ASTM C90).
 - c) “Test Method Sampling and Testing Concrete Masonry and

Related Units" (ASTM C140).

- d) "Specification for Portland Cement" (ASTM C150).
- e) "Standard Specification for Aggregate for Masonry Mortar" (ASTM C144).
- f) "Specification for Hydrated Lime for Masonry Purposes" (ASTM C207).
- g) "Standard Specification for Mortar for Unit Masonry" (ASTM C270).
- h) "Standard Specification for Aggregate for Masonry Grout" (ASTM C404).
- i) "Specification for Grout for Masonry" (ASTM C476).
- j) "Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry" (ASTM C780)

1.3 QUALITY ASSURANCE

- A. All masonry work shall comply with the standards and requirements of the above references. Where discrepancies exist between the references and the Contract Documents, the requirements of the Contract Documents shall govern.
- B. Allowable Tolerances:
 - 1. Unit masonry shall be fabricated within 1/8-inch of dimensions noted.
 - 2. The maximum variation from plumb of walls shall be 1/8" in 20 feet.
 - 3. Joints shall have a uniform thickness of 3/8" unless otherwise noted. Joints shall not vary more than 1/16" in adjacent courses within two feet and shall not be less than 5/16" thick and not greater than 7/16" thick.
 - 4. Constructed masonry shall comply with the tolerances specified in ACI 530.1, article 3.3.
- C. Reinforcing Steel:
 - 1. Reinforcing steel shall not be permitted to rust where there is danger of staining exposed surfaces of adjacent concrete.
 - 2. The Contractor shall replace rust-stained concrete and/or masonry at his expense.
- D. Examination Criteria: All examinations, selections and approval shall be for the purpose of achieving a final installation of the unit masonry with the greatest

possible uniformity of appearance and structural integrity based on the following criteria:

1. Testing and quality assurance measures outlined in this specification.
2. Color and texture shall match the approved mock-up for range, random variation and finish. The quality of construction shall match the approved mock-up.
3. Conformance to the contract documents and approved shop drawings within specified dimensions and tolerances.
4. Only one source for concrete masonry units shall be used throughout the work.
5. Other criteria as specified in this Section.
6. Non-conformance with any or all of the above criteria shall be grounds for removal and replacement of the work without expense to the Owner. The Architect shall determine if the work complies with the above criteria.

E. The Owner's Testing Agency will:

1. Collect plant certificates from the Contractor for concrete masonry units, stating that all units have been properly cured before shipment and that they conform to all the requirements of these specifications. All masonry units shipped without certification will be rejected.
2. Field test masonry unit moisture content prior to block installation. See Section 3.07, Field Quality Assurance.
3. Submit material test reports indicating and interpreting test results relative to compliance with the tests described in this Section and Section 3.7 Field Quality Assurance.

1.4 SUBMITTALS

A. Manufacturer's literature: Submit manufacturer's literature describing products, including mix designs, history of compression tests, and mixing requirements as they apply to each different masonry unit, accessory and other manufactured product to be used in the unit masonry construction. Literature shall include, but not be limited to, preformed rubber control joints and all additives.

B. Certificates:

1. Submit material certificates for the following signed by the manufacturer and the Contractor certifying that each material complies with requirements designated.
 - a) Each material and grade of reinforcing bars. See Section 03 20 00, Concrete Reinforcing.

- b) Each type and size of anchors, inserts, ties and accessories.
- 2. The Contractor shall submit a certificate of compliance with the standards designated.
- 3. Submit plant certificates for all concrete masonry units to the Owner's Testing Agency and Architect, stating that all units have been properly cured before shipment and that they conform to all requirements of these specifications, including but not limited to, requirements for moisture content per ASTM C90.
- C. Mix Designs: Submit mix designs for mortar and grout where the proportions do not comply with ASTM C270 Table 1 for mortar and ASTM C476 Table 1 for grout. Mix designs shall include a history of compression tests that substantiate the compressive strength of the mix in accordance with CBC section 1905A.2. Submit the manufacturer's literature for grout admixtures.
- D. Unit Samples: Submit sample concrete masonry units in each color and texture combination specified
- E. Samples: Submit samples of all accessories embedded in masonry.
- F. Mill Test: Submit mill test reports for all reinforcing steel.
- G. Extreme Weather Procedures: Submit cold-weather and hot-weather construction procedures evidencing compliance with requirements specified in ACI 530.1, CBC, and these specifications.
- H. Shop Drawings: Coordination and shop drawings for all concrete masonry unit walls. Drawings shall consist of elevations and sections indicating materials and assembly, color surface finish, courses and reinforcing. Shop drawings shall meet the following requirements:
 - 1. The shop drawings shall illustrate detailing, fabrication, bending and placement of unit masonry reinforcing bars. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars and arrangements of masonry reinforcement. The shop drawings shall also indicate the location of all conduit, plumbing and other items embedded in unit masonry walls and coordinate this work with the placement of the unit masonry reinforcement.
 - 2. All shop drawings shall be drawn to scale.
- I. Mock-Up: Prior to installing concrete masonry units, construct the following out-of-sequence mock-up for each form of construction and finish required to demonstrate aesthetic effects and qualities of materials and installation. Build mock-up to comply with the following requirements:
 - 1. Submit shop drawings of the mock-up showing plan and elevation, mock up wall footing and lateral bracing.

2. Locate on site in the location and size as directed by the Architect.
3. Notify the Architect 7 days in advance of the dates and times when mock-up will be constructed.
4. CMU exterior wall corner with installed window and precast sill: The mock-up shall be 8 feet long on one wall and 4 feet long on the other wall. The walls shall meet at an exterior outside corner. Both walls shall be 6'-0" high. The mock-up shall also demonstrate a vertical joint with the glazed curtain wall system, a vertical expansion joint with sealant and a continuous parapet cap over the CMU walls. The window shall be located in the center of the 8' wall of the mock-up. Include required application of masonry sealer or water repellent coating.
5. Demonstrate the proposed maximum range of color and texture variation and the quality of workmanship.
6. Obtain the Architect's approval of mock-ups before beginning installation.
7. Retain and maintain mock-up during construction in an undisturbed condition as a standard for judging the completed work. Remove from the site and properly dispose of mock-ups, with the Architect's approval, at the end of Substantial Completion.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver and store packaged material in original containers with seals unbroken and labels intact until time of use.
- B. At the time of delivery to the site, masonry units shall conform to the linear shrinkage requirements of ASTM C90.
- C. Unload and inspect each masonry unit carefully and store on raised platform protected from weather so as to meet ASTM C90 requirements at the time of laying and grouting. Reject and remove from the site all material not conforming to specification requirements. In addition to lack of conformance to manufacturers' specifications, masonry units shall be rejected if:
 1. The color or texture of the concrete masonry units deviates from the range of colors and textures displayed on approved mock-up, as determined by the Architect.
 2. Concrete masonry units are chipped, cracked, or otherwise damaged.
- D. Protect cementitious materials against exposure to moisture. Use of cementitious or other materials that have become caked and hardened from absorption of moisture will not be permitted.
- E. Prior to installation, unload concrete masonry units onto working pallets as described in Section 3.02.E.

1.6 JOB CONDITIONS

A. Environmental Conditions:

1. Do not place unit masonry when temperature is below 40 degrees Fahrenheit, unless the Architect approves and the Contractor provides means for preventing damage from freezing before and after placement.
2. Do not place unit masonry when temperature is above 100 degrees Fahrenheit or above 90 degrees Fahrenheit with a wind velocity greater than 8 miles per hour, unless the Architect approves and the Contractor provides means for preventing damage from dryout before and after placement.

B. Protection:

1. Protect surrounding work as required against damage from masonry work.
2. Clean satisfactorily and correct damage to surrounding work resulting from masonry work.
3. The contractor shall take all means and precautions necessary to protect masonry units from moisture absorption during shipping, storage on site, placement prior to grouting of wall, during wall construction until the masonry wall is completed and water repellant coating is applied.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hollow Load-Bearing Concrete Masonry Units: As manufactured by Basalite, Calstone, or approved equal. Light weight (105 pcf) open end type concrete block size 8 x 8 x 16-inches or 12 x 8 x 16-inches, conforming to ASTM C90, (0.065 maximum allowable linear shrinkage). Provide compressive strength as required by CBC Table 2105A.2.2.1.2 for the specified compressive strength of masonry and type of mortar indicated on drawings. The colors listed are Basalite. Submitted colors must match Basalite colors.

1. Type A - Split Face; Color - _____
2. Type B - Precision Face; Color - _____

- B. Portland Cement: ASTM C150, Type II.

C. Aggregates:

1. For Mortar: ASTM C144.
2. For Grout: ASTM C404.

- D. Hydrated Lime; ASTM C207, Type S.
- E. Quick Lime: ASTM C5.
- F. Reinforcing Bars: Comply with the requirements of Section 03 20 00, Concrete Reinforcing.
- G. Water: Clean and potable, free from impurities detrimental to mortar and grout.
- H. Control Joints: Preformed rubber in profiles required or shown. Same as Sonneborn-Contech's "Masonry Control Joints"; Dur-O-Wal National Inc.'s "Rapid Control Joint"; or equal product substituted per Section 01630.
- I. Mortar Coloring: Mineral oxide type.
- J. Additives and Admixtures: Required in all grout to reduce early water loss to the masonry units and produce expansive action in the plastic grout to offset the initial shrinkage and promote bonding of grout to the interior masonry unit surfaces. Use Grout Aid by Sika Corporation or approved equal. Obtain approval of admixture by Architect, Structural Engineer and Owner's Testing Agency.
- K. Water Repellant Coating: As specified in Section 07180, Water Repellant Coating.

2.2 FABRICATION

- A. Concrete Masonry Units: Blocks shall have been air cured for not less than 28 days.
- B. Reinforcement:
 - 1. Shop-fabricate to comply with Drawings.
 - 2. Conform to requirements of ACI 315 where specific details are not shown or where Drawings and Specifications are not more demanding.

2.3 MIXES AND MIXING

- A. Mortar:
 - 1. Conform to ASTM C270, Type S or M.
 - 2. Mix in batch mechanical mixer permitting accurate control of water amounts. Site mixing of mortar shall not be permitted without review and acceptance of Contractor's procedure by the Owner's Testing Agency and the Structural Engineer.
 - a) Place approximately half of the required water and sand into the mixer while turning.
 - b) Add cement and remainder of the sand and water into mixer in

that order and mix materials for at least three minutes with minimum of water to produce workable consistency.

- c) Add lime and continue mixing as long as required to secure a uniform mass.
 - d) Total mixing time may not be less than 3 minutes or more than 10 minutes.
3. Use and place mortar in final position within 2½ hours after mixing. Mortar that have stiffened as a result of evaporation of water may be re-tempered with water as frequently as required to restore required consistency during this time period.

B. Grout:

- 1. Compressive Strength: Minimum 2,000 psi after 28 days.
- 2. Slump: 9- to 10-inches. Use sufficient water to make a workable mix that will flow into all joints of the masonry units with typical rates of absorption for ASTM C90. The slump of the grout should be approximately 9 to 10 inches depending on temperature and humidity conditions.
- 3. Proportions by Volume: Shall be per ASTM C476 Table 1. Alternately, the contractor shall submit a grout mix design with a history of compression tests that substantiate the compressive strength of the mix in accordance with CBC section 1905A.2.
- 4. Use grout aid in all grout to reduce early water loss to the masonry units and produce an expansive action in the grout sufficient to offset initial shrinkage. Mix grout admixture in accordance with the manufacturer's recommendations and requirements.
- 5. Grout to comply with ASTM C476 and CBC sections 2103A.12.1, 2103A.12.2, and 2103A.12.3 for materials and mix requirements.
- 6. Site mixing of grout shall not be permitted without review and acceptance by the Structural Engineer.

C. General Mixing Requirements:

- 1. Measure materials accurately.
- 2. Shovel measurements will not be permitted.
- 3. Use mechanical mixer of at least one-sack capacity.
- 4. Completely empty drum before charging succeeding batch of materials.
- 5. Exercise extreme care in measuring ingredients for partial batches.

6. Comply with mixing requirements of CBC 1905A.8.

2.4 SOURCE QUALITY CONTROL

A. The Owner's Testing Agency will:

1. Collect mill test reports for reinforcements under Section 1.04.
2. Take samples of reinforcement and test per Specification 03 20 00, Section 1.03.D.
3. Sample and test concrete masonry units as required by the Unit Strength Method in conformance to CBC 2105A.2.2.1.2, unless prism testing is performed in accordance with Section 3.07.C. Test for compressive strength, unit weight, absorption and moisture content in accordance with ASTM C140.
4. Test for moisture content and drying shrinkage in accordance with ASTM C426.
5. Take and test Portland cement grab sample per Section 03 30 00, 1.9.E.1.d.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive masonry and verify the following:

1. Foundation surface is level to permit bed joint within range of 1/4 to 1 1/4 inch.
2. Edge is true to line to permit projection of masonry to less than 1/4-inch.
3. Projecting dowels are free from loose scale, dirt, concrete, or other bond-inhibiting substances and properly located.

B. Do not begin before unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean concrete surfaces to receive masonry.
- B. Remove laitance or other foreign material lodged in surface by sandblasting or other means as required.
- C. Ensure masonry units are clean and free from dust, dirt, or other foreign materials before laying.
- D. Roughen concrete below walls to expose aggregate; remove loose particles and in hot weather, dampen concrete surfaces before laying blocks. Contact surfaces of all foundations and floors that are to receive masonry work are to be

mechanically roughened to 1/4" amplitude. Comply with CBC 1906A.4.

- E. Ensure random color variations in the installation of CMU. Unload from three delivered pallets onto a "working" pallet to be used for construction. Alternate among pallets when unloading to ensure a mix of CMU on the working pallet.

3.3 REINFORCEMENT

- A. Place bars where noted in accordance with ACI 315, ACI 530 section 1.15, and ACI 530.1 section 3.4. Do not disturb after start of masonry placement.
- B. All horizontal reinforcement shall be laid in bond beam units.
- C. Minimum clearance between bar and CMU is ½-inch or one bar diameter, whichever is greater. Minimum clearance between parallel bars is 1-inch or one bar diameter, whichever is greater. Minimum clearance between vertical bars in a column or pilaster is 1½ -inch or one and one half bar diameters, whichever is greater.
- D. Horizontal and vertical reinforcing shall be held in position by wire positioners or spacing devices near ends and at intervals not to exceed 200 bar diameters, and as required to prevent displacement by construction loads or placement of grout beyond the tolerances allowed by ACI 530.1 section 3.4B, item 8.

3.4 PLACEMENT

- A. General Requirements:
 - 1. Comply with CBC Section 2104A.5.1.2.
 - 2. Ensure masonry units are sound, clean and free of cracking, chipping and broken edges at time of placement.
 - 3. Accurately cut and fit units as required to accommodate other work using masonry saws.
 - 4. Lay masonry units plumb, true to line, with level courses accurately placed.
 - 5. Adjust unit to final position while mortar is soft and plastic.
 - 6. Align vertical cells accurately.
 - 7. Remove units disturbed after stiffening of mortar, clean joints, and relay unit with fresh mortar.
 - 8. In hot weather, moisten contact surfaces of the masonry units to receive mortar immediately before laying to prevent excessive drying of mortar.
 - 9. Do not lay up one tier of wall more than 16-inches ahead of other tier.

10. Where necessary to stop longitudinal run, rack back one-half block length in each course.
11. Do not attach construction supports to walls, except where permitted by the Architect.
12. Install anchors, bolts, and other embedded items accurately as work progresses and prior to grouting.
13. Masonry installer and reinforcing steel installer shall meet and coordinate placement of reinforcing steel prior to placement of concrete or grout.

B. Joints:

1. Fill joints to thickness noted: Ensure full coverage of face shells in both horizontal and vertical joints and on webs.
2. Tool joints as specified on the drawings and achieve solid, smooth, watertight, compacted joints.
3. Joints Exposed to Weather: Point with pointing tools making solid, smooth, watertight joint well bonded to masonry at edges.
4. Immediately fill holes made by line pin with mortar when pin is withdrawn.
5. Remove surplus mortar from joints.

C. Cold Weather Requirements:

1. When daily temperature is below 40 degrees F., ensure reinforcing, masonry units, etc., contacting mortar, and grout are free of frost. Comply with CBC section 2104A.3 and ACI 530.1 article 1.8C for cold weather requirements.
2. Protect all mortar and grout from freezing for at least 48 hours after installation whenever temperature falls below 40 degrees F.
3. Maintain mortar and grout at temperature no lower than 50 degrees F., while being used and until installed.
4. In freezing or near freezing weather, provide equipment of adequate size for heating of mortar and grout.
5. Do not add water to mix at temperature greater than 140 degrees F.

D. Hot Weather Requirements:

1. Implement the requirements of approved Hot Weather construction procedures when ambient air temperature exceeds 100 degrees F or 90 degrees F with a wind velocity greater than 8 mph. Comply with CBC section 2104A.4 and ACI 530.1 article 1.8D for hot weather requirements

E. Protection:

1. Protect face materials against staining.
2. Remove misplaced grout or mortar immediately.
3. Protect sills, ledges, offsets, and similar items from mortar drippings or other damage during construction.

F. Requirements for Walls to be Grouted by High-Lift Method:

1. Lay up walls full story prior to grouting. Brace walls adequately to resist wind lateral and other forces.
2. Build vertical grout barriers or dam of solid masonry across grout space at no more than 25-feet on centers to control horizontal flow of grout.
3. Provide cleanouts by leaving out every other unit in [at every cell] bottom course; seal after inspection and before grouting. Face shell plugs shall have a 24 hour cure time and be adequately braced to resist grout pressure.
4. During laying up, remove mortar fins and other foreign matter from grout space with stick and compressed air.
5. Grout shall be a high slump workable mix placed by pumping.
6. Use mechanical vibrators for consolidation.
7. Grout is to be reconsolidated after it has taken on a plastic consistency but prior to taking on initial set.
8. A "pour" is considered as the entire height of grout fill placed in one day and is composed of a number of successive placed grout lifts. A "lift" is the layer of grout placed in a single continuous operation.
9. Maximum height of pour will be twelve feet for eight inch walls, sixteen feet for twelve inch walls.

G. Concrete Masonry Units:

1. Bond: Running bond, unless specifically noted otherwise.
2. Joint Thickness: 3/8-inch, both vertically and horizontally.
3. Joint Treatment:
 - a) Where exposed, all mortar joints shall be tooled joints.
 - b) Where concealed, cut off mortar flush with face of work using trowel.

4. Use double open ended beam units to the extent practical. At no time should blocks with closed ends be placed back to back. Use proper units to provide for windows, doors, bond beams, lintels, pilaster, etc., in order to minimize cutting.
5. Do not wet units.
6. Align vertical cells to provide continuous, unobstructed opening for grouting.
7. Corners: Provide standard masonry bond by overlapping units.

3.5 GROUTING

A. General Requirements:

1. Use high-lift or low-lift grouting, at the Contractor's option pending Enforcement Agency official approval. Do not pour grout until mortar has set sufficiently such that grouting will not cause movement in the mortar joints or masonry units. Grout walls as soon as possible after mortar has cured.
2. Grout all cells of concrete block.
3. Ensure grout flows into voids and completely surrounds reinforcing steel.
4. Stop grout approximately 1-1/2 inches below top of last course (1/2" at bond beams with horizontal steel), except at top course, bring grout flush with top of block.
5. Grout from inside face of masonry wherever possible.
6. Where necessary to stop longitudinal run, provide suitable dam to retain grout in place.
7. Do not wet down grout spaces prior to grouting.

B. Low-Lift Grouting: Comply with CBC Section 2104A.5.1.2.2.

1. Pour grout to a maximum height of 4-feet, stopping 1-1/2-inches below top of unit except at bond beam units with horizontal steel the grout shall be stopped 1/2-inch below top of unit.
2. Delay 3 to 5 minutes allowing the excess of water to be absorbed by the masonry unit, then consolidate by vibrating.
3. Layup and grout next 4-feet of wall height.

C. High Lift Grouting: Comply with CBC Section 2104A.5.1.2.3.

1. Coordinate the procedure with the DSA Field Engineer prior to

construction, with a written procedure plan.

2. Ensure cleanout has been sealed before grouting.
3. Pour first lift to a depth not in excess of 4 feet, with a waiting period between subsequent lifts of thirty to sixty minutes, sufficient to permit grout to become plastic but not set.
4. Place the first lift of grout to a uniform height, wait 3 to 5 minutes, and mechanically vibrate thoroughly to fill all voids. Subsequent lifts should be poured and alternate cells vibrated twelve inches to eighteen inches into the preceding lift.
5. Complete pour in sequence with other lifts not in excess of 4 feet.
6. If grout pour is 6-feet or less, it may be placed in one lift. If total pour exceeds 6-feet, the grout shall be placed in 4-foot lifts.
7. Grouting operations shall be conducted such that pours are limited to successive lifts which can be placed within one hour of the preceding lift.
8. Reconsolidate the top lift after the required waiting period to fill any space left by settlement and shrinkage.
9. Repeat the waiting, pouring, and reconsolidation steps until the top of the day's pour is reached.
10. Construction Joints: In the high lift grouting method, intermediate horizontal construction joints are not permitted. Plan the work for one continuous pour of grout to the top of the wall in four foot layers or lifts in the same working day. Should a blow-out, equipment breakdown, or any other emergency occur, cease the grouting operation. An alternate procedure may be used with the approval of the Architect or Structural Engineer and (OSHDP)(DSA).
11. The section of wall to be grouted in any one pour is limited to a length in which successive lifts can be placed within one hour of the preceding lifts. Vertical control barriers shall be placed between pour sections in locations approved by the Architect or Structural Engineer and (OSHDP)(DSA).

3.6 POINTING AND CLEANING

- A. Point holes or defective mortar joints upon completion of work; where necessary, cut out and re-point defective joints.
- B. At end of work day, fiber-brush new surfaces to remove mortar splashes, clean with mild detergent or enzymes, and rinse with clean water.
- C. Do not use acid solution to remove green stain or efflorescence resulting from salts; follow recommendations of manufacturer for removal of such stains.

- D. Upon completion of work, remove from site surplus materials, rubbish, and debris resulting from this work.

3.7 FIELD QUALITY ASSURANCE

- A. Special Inspection: The Owner shall employ an approved, qualified masonry inspector to perform masonry inspection per CBC 1701A and 1704A. [Acceptance by a State or Municipality having a program of examining and certifying masonry inspectors will be considered adequate qualifications.] [Special inspectors shall be pre-qualified by (DSA)(OSHPD).] The masonry inspector shall provide inspection of masonry construction in accordance with CBC 1704A.5 and perform the following duties:
1. Review plans and specifications and meet with the Contractor to discuss requirements before work commences.
 2. Before masonry work commences, meet with the Contractor and the Architect in a joint meeting to review the requirements for surveillance and quality control of the masonry work.
 3. Check brand and type of cement, lime (if used) and source of sand.
 4. Inspect the foundation or slab to ascertain that it is clean and ready to receive units.
 5. Check reinforcing steel dowels for straightness, proper alignment, spacing, size and length.
 6. Observe manner in which units are laid up to ensure that joints are full of mortar and kept tight during work. Inspect cells to assure that fins will not interfere with grouting or foaming. Instruct masons to keep cells clean of mortar droppings and inspect to determine compliance.
 7. Observe placing of grout continuously.
 8. Perform or supervise performance of required sampling and field testing as specified.
 9. Keep complete record of inspection of work. Report daily to the Owner's Representative the progress of the masonry inspection.
 10. Submit verified reports to DSA (OSHPD).
- B. Mortar and Grout Testing: The Owner's Testing Agency shall take and test mortar and grout samples as follows:
1. Take test samples of mortar and grout on each of three consecutive working days at the start of the project.
 2. Take test samples at intervals not exceeding one week for the remainder of the project.

3. Take additional test samples whenever a change in materials or job conditions occurs.
 4. Tests shall verify that the mortar and grout comply with their respective specified compressive strengths
- C. Mortar and Grout Testing: The Owner's Testing Agency shall take and test mortar and grout samples in accordance with CBC Section 2105A.5. Tests shall verify that the mortar and grout comply with their respective specified compressive strengths.
- D. Prism Test: At the contractor's option, masonry prism testing may be performed in lieu of mortar and grout testing as follows:
1. The Owner's Testing Agency will perform prism testing in accordance with CBC section 2105.2.2.2. Prior to construction, a set of 5 masonry prisms shall be built and tested using materials taken from those specified for this project. During construction test 3 prisms for each 5,000 sq. ft. of wall area and as additionally required by the Architect.
- E. Prism Test: Where the compressive strength of masonry (f'm) is specified as greater than 1,500 psi, the strength shall be justified by masonry prism testing in accordance with CBC Section 2105A.2.2.2:
1. The Owner's Testing Agency will perform prism testing in accordance with CBC Section 2105A.2.2.2. Prior to construction, a set of 5 masonry prisms shall be built and tested using materials taken from those specified for this project. During construction test 3 prisms for each 5,000 sq. ft. of wall area and as additionally required by the Architect.
- F. Masonry Core Tests: The Owner's Testing Agency shall take and test masonry cores from the constructed masonry in accordance with CBC Section 2105A.4. Take cores in locations designated by the Architect. Contractor shall restore walls with whole face shells or complete units as approved by the Architect. One half of the cores shall be tested for bond strength at the joint between the masonry and the grout.

END OF SECTION

SECTION 04 43 00**STONE MASONRY****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Exterior stone at retaining wall.
 - 2. Setting beds, grouts, and accessories as required for complete stone installation.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 07 92 00 - Joint Sealants: Provision of sealants.

1.02 REFERENCES

- A. ANSI - American National Standards Institute
 - 1. A108.1 - Specification for the Installation of Ceramic Tile.
 - 2. A118.6 - Specifications for Ceramic Tile Grouts.
- B. CBC - California Building Code, 2022 Edition

1.03 SUBMITTALS

- A. Product Data: Submit product data for each type of stone, stonework accessory, and other manufactured products required.
- B. Shop Drawings: Submit shop drawings detailing fabrication and installation of stone. Include cutting and setting drawings indicating sizes, dimensions, sections, and profiles of stones; arrangement and provisions for jointing, supporting, anchoring, and bonding stonework; and details showing relationship with, attachment to, and reception of related work.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Stone
 - 1. Type: Stone sourced from North Fork Quarry Area.
 - a. Obtain Local Rock Collection Permit per National Forest Service. Apply at Bass Lake Ranger Station, Attention: Leslie Van Meter.
 - 2. Dimensions: Random.
 - 3. Finish: As selected by the Architect.
 - 4. Color: As selected by the Architect.
- B. Mortar Bed: ANSI A108.1.
- C. Bond Coat: Latex portland cement mortar on a cured bed.
- D. Grout: ANSI A118.6, latex portland cement grout.
- E. Water: Clean, nonalkaline, and potable.

- F. Sealant Products: Provide manufacturer's standard chemically curing, elastomeric sealants that are compatible with joint fillers, joint substrates, and other related materials and comply with requirements of Section 07 92 00.

2.03 STONE FABRICATION

- A. General: Fabricate dimension stonework in sizes and shapes required to comply with requirements indicated, including details on Drawings and final shop drawings.
- B. Cut and drill sinkages and holes in stones for supports and lifting devices as needed to set dimension stonework securely in place; shape beds to fit supports. Cut holes in stone for sinks and tub.
- C. Dress joints straight and at 90 degree angle to face, unless otherwise indicated.
 - 1. Cut stones to produce joints of uniform width of 1/8-inch and in locations indicated.
 - 2. Clean sawn backs of stones to remove rust stains and free iron particles.
- D. Finish exposed faces and edges of stones.

2.04 MORTAR AND GROUT MIXES

- A. General: Comply with referenced standards and with manufacturers' instructions relative to mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality and with optimum performance characteristics.

PART 3 - EXECUTION

3.01 SETTING DIMENSION STONE, GENERAL

- A. Execute dimension stonework by skilled mechanics, and employ skilled stone fitters at the site to do necessary field cutting as stones are set. Use power saws to cut stones; for exposed edges, produce edges that are cut straight and true, unless otherwise indicated.
- B. Contiguous Work: Provide openings as indicated for accommodating contiguous construction.

3.02 SETTING STONEWORK WITH MORTAR

- A. Set stone in random pattern as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
- B. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
- C. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- D. Wet joint surfaces thoroughly before applying mortar or setting in mortar.
- E. Coat backs of stone units and face of substrate with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between stone units and face of substrate.

- F. Rake out mortar from joints to depths of not less than 1/2-inch nor less than that required to provide sufficient depth for sealant and sealant backing for joints pointed with sealants.
 - 1. Apply sealant to joints to comply with applicable requirements of Section 07 92 00.

3.03 ADJUSTING AND CLEANING

- A. Remove and replace or repair stonework that is broken, chipped, stained, or otherwise damaged.
- B. Clean dimension stonework not less than 6 days after completion of work, using clean water and stiff bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.

END OF SECTION

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SECTION 05 12 00**STRUCTURAL STEEL****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes: Provision of structural steel as indicated on the Contract Drawings. Work includes but is not necessarily limited to the following:
1. Structural steel framing, including all structural steel shown on the structural drawings and all standard shapes, plates and rods shown on the Architectural, Mechanical and Electrical drawings that connect to the building structure.
 2. Elevator rail bracing.
 3. Welded stud connectors for composite construction, concrete engagement, and attachment of building components.
 4. Anchor rods.
 5. Shop painting.
 6. Teflon slide bearing pads.
- B. Related Sections:
1. Section 03 20 00 - Concrete Reinforcement
 2. Section 03 30 00 – Cast-In-Place Concrete
 3. Section 05 50 00 - Metal Fabrications

1.02 REFERENCES

- A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply).
1. California Building Code (CBC), 2019 Edition.
 2. American Society for Testing and Materials (ASTM).
 3. American Institute of Steel Construction:
 - a. "Specification for Structural Steel Buildings" (ANSI/AISC 360-10).
 - b. "Specification for Structural Joints Using ASTM A325 or A490 Bolts, December 31, 2009" (AISC 348).
 - c. "Code of Standard Practice for Steel Buildings and Bridges," (AISC 303-10).
- 1) No provision of AISC 303 shall be effective to change the duties and responsibilities of the Owner, Contractor or Structural Engineer from those set forth in these Contract Documents.
 - 2) Where discrepancies exist between the requirements of the Contract Documents and AISC 303, the requirements of the Contract Documents shall govern.

- d. "Seismic Provisions for Structural Steel Buildings" 2010 (AISC 341).
- 4. American Welding Society:
 - a. "Structural Welding Code -- Steel" (AWS D1.1), 2010.
 - b. "Seismic Welding Supplement" (AWS D1.8), 2009.
 - c. "Standard Symbols for Welding, Brazing and Nondestructive Examination (AWS A2.4).
 - d. "Filler Metal Specifications" (AWS A5).
 - e. "Criteria for Describing Oxygen-Cut Surfaces and Oxygen Cutting Surface Roughness Gauge" (AWS C4.1).
 - f. "Standard for AWS Certification of Welding Inspectors" (AWS QC1).
- 5. Society of Protective Coatings:
 - a. Solvent Cleaning (SSPC-SP 1).
 - b. Hand Tool Cleaning (SSPC-SP 2).
 - c. Brush-Off Blast Cleaning (SSPC-SP 7).
- 6. American Society of Non-Destructive Testing:
 - a. ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-189-2011).
 - b. Personnel Qualification and Certification in Nondestructive Testing, 2011 (ASNT Recommended Practice No. SNT-TC-1A).

1.03 DEFINITIONS

- A. AECS – Architecturally Exposed Structural Steel. Items designated "AECS" on the drawings are subject to special requirements in this provision and in AISC 303.
- B. Demand-Critical Welds: Demand-Critical Welds are designated on the structural drawings. All Demand-Critical Welds are part of the Seismic-Load-Resisting System.
- C. Extra Smooth: Surfaces noted herein as "Extra Smooth" require a finish with surface variation of 500 micro-inches or less (AWS C4.1, Sample #4).
- D. Gouge: any depression deeper than the overall surface roughness.
- E. Heavy Sections: Rolled and built-up sections as defined below.
 - 1. ASTM A6 Group 3 shapes with flanges thicker than 1 1/2."
 - 2. ASTM A6 Group 4 and Group 5 shapes.
 - 3. Welded built-up members with plates exceeding 2" in thickness,
 - 4. Column base plates exceeding 2" in thickness.
- F. Nondestructive Testing: Nondestructive testing (NDT) includes magnetic particle testing (MT), penetrant testing (PT), radiographic testing (RT), and ultrasonic testing (UT). The terms nondestructive examination (NDE) and nondestructive testing (NDT) are synonymous.
- G. Protected Zone: The Protected Zone is defined as structural members, or portions thereof, to which connections of structural and non-structural elements are limited. The Protected Zone is designated on the structural drawings.
- H. Quality Assurance Plan: The Quality Assurance Plan is set of the written requirements containing the set of qualification requirements and procedures that are to be followed by the

Owner's Testing Agency to confirm compliance with these requirements.

- I. Seismic-Load-Resisting System (SLRS): The Seismic-Load-Resisting System (SLRS) is defined as all items designated "SLRS" on the Structural Drawings, including columns, beams, and braces, and their connections along grid lines denoted "SLRS" on the framing plans.

1.04 QUALIFICATIONS

- A. Steel Fabricator's Qualifications: Fabricator shall have had not less than 5 years' experience in fabrication of structural steel and be able to furnish evidence of his ability, facilities, proficiency of his personnel and completed projects.
- B. Steel Erector's Qualifications: Erector shall have had not less than 5 years' experience in erection of structural steel and be able to furnish evidence of his ability, facilities, proficiency of his personnel and completed projects.
- C. Welder Qualifications: Welders, welding operators, and tackers shall be qualified in accordance with AWS D1.1.
 1. Welders shall have a valid Welding Performance Qualification Record (WPQR) for each welding procedure to be performed.
 2. Welders whose work fails to pass inspection shall be requalified before performing further welding.
 3. Supplemental Welding Personnel Testing: Welders and welding operators performing work on bottom-flange Demand-Critical Welds shall pass the Supplemental Welder Qualification Testing, as required by AWS D1.8, Section 5.1. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification..
 4. Qualification Period: Personnel who have not welded for a period of three or more months shall be requalified. Welding personnel required to be tested using the Supplemental Welding Personnel Testing shall be qualified by test within 12 months prior to beginning welding on the project.
 5. The Contractor shall pay costs of certifying qualifications and requalifications.

1.05 QUALITY ASSURANCE

- A. Welding Inspector Qualifications:
 1. All Welding Inspectors shall be trained and thoroughly experienced in inspecting welding operations, and qualified as Certified Welding Inspectors (CWI) in accordance with AWS D1.1 and AWS QC1.
 2. NDT Personnel Qualifications
 - a. NDT personnel shall be qualified under one of the ASNT documents referenced in this specification. NDT performed by NDT Level I personnel shall be under the close, direct supervision of an NDT Level II.
 - b. Demand-Critical Welds: UT may be performed only by UT technicians certified as Level II by their employer, or as ASNT Level III certified by examination by the ASNT. Ultrasonic testing technicians who perform flaw detection or sizing shall be trained in applicable UT procedure and shall demonstrate their competence through testing as prescribed in AWS D1.8, Annex E.
- B. Bolting Inspector Qualifications: Competency shall be demonstrated through the

administration of a written examination and through the hands-on demonstration by the Inspector of the methods to be used for bolt installation and inspection.

C. Submittals: The Owner's Testing Agency will submit the following items:

1. Quality Assurance Plan: The Quality Assurance Plan shall contain the Quality Assurance and Inspection items contained in this Section.
2. Qualifications of Owner's Testing Agency management and personnel designated for the project.
3. Qualification records for Owner's Testing Agency's Inspectors and NDT technicians designated for the project.
4. Owner's Testing Agency's Quality Control Plan for the monitoring and control of the Agency's operations.
5. Written Practice for Owner's Testing Agencies: The Owner's Testing Agency shall maintain a Written Practice for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualification and certification of inspection personnel, including those of subcontracting agencies. The Written Practice shall also describe the Agency's procedures for determining the acceptability of the structure in accordance with the applicable codes, standards, and specifications. The Written Practice shall also describe the Agency's inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.
 - a. Bolting Inspection Procedures: Comply with AISC 348 and the Quality Assurance Plan.
 - b. Welding Inspection Procedures: Meet the requirements of the AWS D1.1 and the Quality Assurance Plan.
 - c. Nondestructive Testing Procedures: The Written Practice shall describe the responsibility of each level of certification for determining the acceptability of material and welds in accordance with the applicable codes, standards, specifications and procedures.

1.06 SUBMITTALS

A. The following items shall be submitted to the Architect for review. One reproducible copy will be returned. Do not fabricate material prior to obtaining final review of submittals.

1. Manufacturer's test reports and literature describing products excluding those listed in Section 1.06B.
2. Plans of all levels showing dimensioned location of edge of slab, deck, and openings. Submit prior to Shop and Erection drawings.
3. Shop and Erection Drawings. Prior to the start of fabrication and erection, submit detailed shop and erection drawings for all structural steel showing:
 - a. Size and location of all structural members and connection material.
 - b. Type, size and location of bolts and welds.
 - c. Identification of high-strength bolted joints as snug-tight, pretensioned or slip-critical, as required by the Contract Documents.
 - d. Locations where the Construction Documents require weld backing to be removed.
 - e. Locations where the Construction Documents require supplemental fillet welds where backing is permitted to remain.
 - f. Locations where the Construction Documents require weld tabs to be removed.

- g. Identification of members and connections of the Seismic-Load-Resisting System.
 - h. Location and dimensions of the Protected Zone.
 - i. Identification of welds in the Seismic-Load-Resisting System.
 - j. Identification of Demand-Critical Welds.
 - k. Identification of connections and members, or portions thereof, to be treated as AESS.
 - l. Clear identification of revisions and revision dates in accordance with AISC 303.
 - m. Other items as required by AISC 303 or AISC 341, Section 5.
 - n. Shop drawings shall include the following additional information:
 - 1) Complete information necessary for the fabrication of members including cuts, copes, holes (including weld-access and galvanization venting and drainage), doubler plates, stiffeners, and camber.
 - 2) Surface preparation and finishes, including both painting and grinding.
 - 3) Material grades of all members, connection material, fasteners, and weld filler metal.
 - 4) Connection details drawn to scale for members of the Seismic-Load-Resisting System.
 - 5) With each shop-drawing submittal, a corresponding erection drawing (or set of drawings) identifying pieces. Erection drawings included in shop-drawing submittals will not be considered part of the submittal and will be neither reviewed nor returned unless they are marked "FOR REVIEW" and have clear identification of revised or new information. Clouding is one acceptable form of identifying revised or new information.
 - o. Erection drawings shall include the following additional information:
 - 1) Identification mark of members.
 - 2) Orientation and relation of members to appropriate grid lines.
 - 3) Setting elevations for column bases.
 - 4) Standard and special details for field connections.
 - 5) Identification of joints or groups of joints in which a specific assembly order, welding sequence, welding technique, or other special precautions are required.
 - p. Samples: Material samples shall be provided as requested by the Structural Engineer or Owner's Testing Agency.
- B. The following items shall be submitted to the Architect and Owner's Testing Agency. Submittal to the Architect is for record purposes only. No copies will be returned by the Architect.
- 1. Manufacturer's test reports and literature describing products:
 - a. Structural Steel: Material test reports (MTRs), also called mill test reports, for all structural steel. MTRs shall comply with the requirements of ASTM A6. MTRs shall be accompanied by a Certificate of Compliance from the fabricator. Structural steel shall be identified in accordance with CBC Section 2203A.
 - b. Fastening Material: Manufacturer's Certifications for fastener components, including bolts, nuts, washers, and direct tension indicators (if used), accompanied by a Certificate of Compliance from the Contractor. Manufacturer certifications shall contain:
 - 1) Heat analysis, heat number, and a statement certifying that prohibited elements were not added to produce the bolts.
 - 2) Results of hardness, tensile, and proof load tests, as required and

- performed.
- 3) If galvanized, measured zinc coating weight or thickness, and the results of rotational capacity tests, including test method used (solid plate or tension measuring device) and lubricant present.
- 4) Results of visual inspection for bursts.
- 5) Statement of compliance with dimensional and thread fit requirements.
- 6) Lot number and purchase order number.
- 7) For A490 bolts, only the Production Lot Method of testing and certification is acceptable. Shipping Lot Method is not acceptable.
- c. Welding Consumables: Submit the following items:
 - 1) Manufacturer's Certifications for electrodes, fluxes and shielding gasses to be used. Certifications shall satisfy AWS A5 requirements. In addition submit a Certificate of Compliance from the Contractor supplying the materials. Submit certifications that the product meets any additional requirements of the project.
 - 2) Manufacturer's product data sheets for all welding material to be used. The data sheets shall describe the product, limitations of use, recommended welding parameters, and storage and exposure requirements, including baking and rebaking.
- d. Welded Stud Connectors: Submit the following items:
 - 1) Manufacturer's Certification that the studs, as supplied, meet the requirements of AWS D1.1.
 - 2) Certified copies of the stud manufacturer's test reports covering the last completed set of in-plant quality control mechanical tests for the diameter supplied.
 - 3) Certified material test reports from the manufacturer. The Manufacturer's Certification shall be accompanied by a Certificate of Compliance from the Contractor.
- 2. Bolting and Welding Procedures: Procedures shall assign responsibility to a person or position and shall contain enough detail to be useful to the workforce without reference to governing specifications. The procedures need not act as work instructions. Procedures shall be dated and indicate the person or position that has the authority to maintain the procedure.
 - a. Fastener Installation Procedures: Submit written procedures for the pre-installation testing, installation, snugging, pre-tensioning, and post-installation inspection of high strength fasteners.
 - b. Welding Procedure Specifications (WPSs): Welding Procedure Specifications (WPSs) shall conform to the requirements of AWS D1.1. Submit Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQR) as required by AWS D1.1, to be used on the project to the Owner's Testing Agency.
 - c. Use forms provided in Annex E of AWS D1.1 or equivalent.
 - d. Weld Sequence Procedures: Submit written procedures indicating field welding sequences for each type of connection with multiple field-welded joints, and the sequence of such connections to be field-welded at each level.
 - e. Weld Shrinkage and Distortion Control Plan: Where shrinkage is likely to cause distortion or other problems, submit a mitigation plan. The contractor is responsible for determining conditions requiring a Weld Shrinkage and Distortion Control Plan.
- 3. Welding Performance Qualification Records (WPQRs): Written Welding Performance Qualification Records (WPQRs), in accordance with AWS D1.1, for all welders on the

project. Submit documentation that the welder has passed all designated supplemental welder qualification testing required for the types of welding to be performed. Submit documentation showing that the welder continued to use the applicable welding process on an ongoing basis since the WPQR test was conducted.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.
- B. Structural steel shall be stored and handled in a manner that prevents damage or distortion. Discharge materials carefully; do not dump onto ground.
- C. Do not store materials on the structure in a manner that might cause distortion or damage to members of the supporting structure.
- D. Store structural steel members, whether on or off site, above ground on platforms, skids, or other support; store other materials in weather-tight, dry place until use.
- E. Store materials to permit easy access for inspection and identification.
- F. Electrode Requirements:
 - 1. Packaging of weld filler metals shall conform to the requirements of AWS D.1.1. FCAW electrodes shall be received in undamaged moisture-resistant containers. They shall be protected against contamination and injury during shipment and storage. When removed from protective packaging and installed on machines, care shall be taken to protect the electrodes and coatings from deterioration or damage.
 - 2. Modification or lubrication of an electrode after manufacture is not permitted, except that drying shall be permitted when recommended by the manufacturer.
 - 3. Electrode Storage and Exposure Limits for Demand-Critical Welds: The exposure time limit for electrodes shall be in conformance with AWS D1.8 Section 6.4.
- G. Fasteners shall be stored in a protected place. Except for ASTM F1852 "twist-off" type assemblies, clean and relubricate bolts, nuts and washers that become dry or rusty before use. F1852 fastener components may be relubricated following the manufacturer's written instructions, and must be retested after relubrication and prior to use to verify suitability for installation.

1.08 JOB CONDITIONS

- A. Provide the Owner's Testing Agency with free access to places on and off job site where materials are stored or fabricated, to places where equipment is stored or serviced, and to job site.
- B. Sequencing, Scheduling:
 - 1. Notify the Architect and Owner's Testing Agency in sufficient time prior to shop or field fabrication and erection to permit testing and inspection without delaying Work.
 - 2. Ensure timely delivery of items to be embedded in work of other sections; furnish setting drawings and directions for installation
 - 3. Provide templates for setting of anchor rods.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Steel Shapes, Plates, Tube, Pipe, and other sections: As noted on drawings.

2.02 Heavy Sections:

1. Heavy Sections in the Seismic-Load-Resisting System shall be supplied with Charpy V-notch (CVN) testing in accordance with AISC 341 requirements.
2. Plates and Flanges in Heavy Sections shall be free of laminations within 3" of areas to be welded with complete-joint-penetration welds.

- B. Standard Threaded Fasteners:

1. Machine Bolts and Nuts: ASTM A307, Grade A.
2. Plain Washers: ASTM F844.
3. Beveled Washers: ANSI B18.23.1.

- C. High Strength Bolts, Nuts, and Washers:

1. ASTM A325-N, snug-tight, unless otherwise noted.
2. Bolted joints in the Seismic-Load-Resisting System shall be Slip-Critical, with pretensioned high-strength bolts and a Class A faying surface or better.
3. Twist-off-Type Tension-Control Bolt Assemblies: ASTM F1852 or ASTM F2280.
4. Direct Tension Indicators: Load Indicator Washers: ASTM F959
5. Nuts for High Strength Bolts: ASTM A563.
6. Washers for High Strength Bolts: ASTM F436.

- D. Welding materials:

1. Comply with AWS D1.1 with a nominal 70 ksi tensile strength.
2. Supplemental Requirements for the Seismic-Load-Resisting System: Welds shall meet the requirements of AWS D1.8 Section 6.

- E. Welded Stud Connectors:

1. Headed Shear Studs: AWS D1.1 "Type B" automatic end-welded headed studs made from ASTM A108, Grade 1015 or 1020.
2. Threaded Studs: Automatic end-welded threaded studs made from ASTM A108, Grades 1010 through 1020.

- F. Anchor Rods and Nuts: ASTM F1554; Grade as noted on drawings.

1. Grade 55 shall be weldable per supplement S1.
2. Grades 55 shall have a minimum CVN toughness of 15 ft-lbs at 40° F per supplement S4.
3. Grade 105 shall have a minimum CVN toughness of 15 ft-lbs at -20° F per supplement S5.

- G. Threaded Rods: As noted on drawings.

- H. Clevises and Turnbuckles: AISI C-1035; in addition clevises and turnbuckles shall have design

strengths corresponding to the 2005 AISC Steel Construction Manual with ultimate capacities at least 200% of the tabulated LRFD values.

- I. Primer
 - 1. Interior steel: primer shall conform to SSPC Paint Specification No. 13.
 - 2. Exterior steel: primer shall conform to SSPC Paint Specification No. 20 (Zinc-Rich Primer)
 - 3. Primer used on walking surfaces shall meet OSHA requirements for slip resistance.
 - 4. Primers shall contain no lead or chromates.
 - 5. Contractor shall verify compatibility with finish paint.
- J. Zinc-Rich Coating for Repair of Galvanized Surfaces: Zinc-rich coatings shall meet the requirements of ASTM A780.
- K. Steel shall conform to the requirements of CBC Section 2205A.

2.03 FABRICATION

- A. General Requirements:
 - 1. Fabricate structural steel in accordance with AISC 360 (Chapter M and Section J2.), AISC 303, and AWS D1.1 as applicable to Statically Loaded Structures, except as otherwise noted herein.
 - a. Assume all thermally cut edges are subject to tension stresses.
 - b. Delete paragraphs M4.6 and M5.1 from Chapter M of AISC 360.
 - 2. Fabricate and assemble work in shop to greatest extent possible.
 - 3. Where possible, use procedures that do not require Architect's approval. Such approval may not be given in some circumstances.
 - 4. Coordinate as required for attachment of other work to structural steel.
 - 5. Where required for passage of reinforcing steel shapes, sections, plates, or bars, for weld access, or for galvanization, drill or punch holes as indicated on Contract Drawings. Notify Architect of conditions not shown or noted.
 - 6. Allowable Tolerances: Comply with AISC 360, Chapter M, and AISC 303, Section 6. Where more restrictive tolerances are necessary to properly install other building systems and components then adopt the more restrictive tolerances.
 - 7. Architecturally Exposed Structural Steel (AESS): All structural steel denoted "AESS" on the drawings shall be fabricated in accordance with the requirements of Section 10 of AISC 303.
 - 8. Holes and attachments to structural steel in areas designated as the Protected Zone are not allowed except as explicitly shown or noted on structural drawings.
- B. Connections:
 - 1. Shop Connections: Bolted or welded as noted.
 - 2. Field Connections: Locate splices only where noted or approved by Architect.
 - 3. To the extent possible, assemble structural steel in the shop prior to galvanization.
- C. Bolted Joints:
 - 1. Punch or drill holes 1/16" larger than bolt size. Material having thickness in excess of

- connector diameter plus 1/8" shall be drilled rather than punched.
2. Ream unfair holes, but only up to next larger bolt size and install a bolt corresponding to the new hole size. Where unfairness exceeds maximum, weld hole in base material solid and drill hole of proper size.
 3. Remove burrs that would prohibit solid seating of connected parts.
 4. Mark completely tightened bolts with identifying symbol.
 5. Provide hardened washers over slotted holes.
 6. Assembly with Standard Threaded Fasteners: Provide beveled washers under bolt heads or nuts resting surfaces exceeding five percent slope with respect to head or nut
 7. Assembly of High-Strength Structural Bolted Joints:
 - a. Meet requirements of AISC 348.
 - b. Seismic-Load Resisting System joints shall be slip-critical (friction-type) as defined in AISC 348 with Class A or better faying surfaces.
 - c. Direct tension indicator washers, where used, shall be provided under the head of slip-critical high strength bolts.

D. Welded Construction: (shop and field)

1. Weld in accordance with AISC 360, AWS D1.1, and CBC Chapter 22A.
2. Welding shall be performed in accordance with the WPS for the joint.
3. Welds that will be permanently exposed to view or that will be painted shall have burrs, flux, welding oxide air spots, and discolorations removed. Surfaces of such welds shall be reasonably smooth and uniform.
4. Exterior welds shall be watertight.
5. Exposed welds in AECS shall be ground, dressed smooth, and flush with adjacent surfaces
6. Each welder working on the project shall be assigned an identification symbol or mark. Each welder shall mark or stamp this identification symbol at each weld completed. Stamps, if used, shall be the low-stress type.
7. Before testing, all welds to be subjected to ultrasonic testing (UT) shall be given a visible mark, "for UT," accurately placed on the steel a distance of 4" away from the root of the edge preparation.
8. Groove welds shall be complete-joint-penetration welds, unless specifically designated otherwise.
9. WPSs shall be available to welders and inspectors prior to and during the welding process. Prior to welding, joint fit-up shall be verified by the welder for conformance with the WPS and AWS D1.1.
10. Supplemental Welding Requirements
 - a. Maximum Preheat and Interpass Temperature: The maximum preheat and maximum interpass temperature permitted is 550° F, measured at a distance of 1" from the point of arc initiation. This maximum temperature may not be increased by the WPS, regardless of qualification testing.
 - b. Nonfusible Backing: The use of nonfusible backing materials, including ceramic and copper, is permitted only with satisfactory welder qualification testing performed using the type of backing proposed for use and using the test plate shown in AWS D1.1, Figure 4.21, except that groove dimensions shall be as provided in the WPS and PQR. For nonfusible weld tabs and short segments of nonfusible weld backing used at the ends of welds between shear plates and column faces, or at the ends of continuity plate welds, special welding personnel and welding procedure qualification testing is not required.
 - c. Peening, Controlled Cooling, and Post-Weld Heat Treatment (PWHT): If peening, controlled cooling, or PWHT are used, they shall be performed in

accordance with AWS D1.1 and a written procedure for their performance shall be incorporated into the appropriate WPS.

- 1) If insulating blankets are used to control cooling a written procedure and temperature measurements are not required.
 - 2) The application of heat immediately following completion of a joint to maintain a nominal temperature at or below 550° F is not considered PWHT.
11. Welded joints of the Seismic-Load-Resisting-System shall conform to AWS D1.8 Section 6.
12. Welded Joint Details:
 - a. Weld Backing: The use of weld backing shall be in accordance with AWS D1.1. Weld backing shall be removed where required by the Contract Documents or for the WPS by AWS D1.1.
 - 1) Heavy Section Splices Requiring Removal of Weld Backing: All welded splices of Heavy Sections, shall have the weld backing removed. Where fusible backing material is used, the root pass area shall be backgouged after backing bar removal, and backwelded until flush or with slight reinforcement. The surface shall then be ground Extra Smooth.
 - 2) Beam-Column Connection Joints Requiring Removal of Weld Backing: Conform with AWS D1.8, Sections 6.7 and 6.8. Perform MT on the fillet weld and the immediately adjacent area.
 - 3) If groove weld backing is permitted to remain, the backing shall not exceed $\frac{3}{8}$ " thickness. For connections of the seismic-load-resisting system in which backing is not removed, backing shall be attached to the member or plate that does not have its surface prepared for the groove weld. Attachment shall be by either a 5/16" fillet or 3/16" groove weld along the complete bar length on the side of the bar opposite the groove weld.
 - b. Weld dams are not allowed.
 - c. Weld Tabs:
 - 1) Use of Weld Tabs: Welds shall be terminated at the end of a joint in a manner that will ensure sound welds. Whenever necessary, this shall be done by use of weld tabs.
 - a) Weld tabs shall extend beyond the edge of the joint a distance equal to a minimum of the part thickness, but not less than 1."
 - b) Weld tabs shall be oriented parallel to the joint preparation and to the weld direction.
 - c) Nonfusible weld tabs may be used in applications and locations where qualified in accordance with AWS D1.1, Section 4.
 - 2) Heavy Section Joint Weld Tab Removal and Finish: All welded tension splices in Heavy Sections, shall have the weld tabs removed and ground Extra Smooth.
 - 3) SLRS Beam-Column Connection Weld Tab Removal and Finish:
 - a) Weld tabs of SLRS connections shall be removed. Removal shall conform to AWS D1.8 Section 6.10.
 - b) In SLRS connections, gouges deeper than 1/16" at locations of removal of weld tabs shall be repaired by welding according to the requirements of this Specification for Deep Gouges. Weld filler metal requirements for Demand-Critical Welds apply. The contour

- of the weld at the ends shall provide a smooth transition, free of gouges and sharp corners. A minimum radius at the corner need not be provided.
- c) Following weld tab removal, finishing, and completion of any necessary repairs, the exposed ends of the weld shall be inspected using magnetic particle testing (MT) or Penetrant Testing (PT).
 - d. Weld toes: Weld toes, whether for groove welds or fillet welds, shall provide a smooth transition between the weld and base metal. The as-welded profile is adequate provided it satisfies the criteria of AWS D1.1, Section 5.24.
 - e. Weld access holes:
 - 1) Weld access holes shall meet the dimensional, surface finish, and testing requirements of AISC 360 Chapter J1.6 and AWS D1.1, except as otherwise required by the Contract Documents.
 - 2) Where the height of the weld access hole exceeds the quantity $k-t_f+1\frac{1}{2}$ " or where the length of the weld access hole exceeds $4 t_f$ (where k and t_f are defined in AISC 360), welded reinforcement is required. Notify the Architect for specific instruction.
 - 3) At welded flange joints that are part of the Seismic Load Resisting System, the weld access hole detail shown in Figure 6.2 of the AWS D1.8 shall be used unless the section is a Heavy Section.
 - 4) The SLRS access hole shall conform to AWS D1.8 Section 6.9.2.
 - 5) SLRS weld access holes shall be inspected using magnetic particle testing (MT) or liquid penetrant testing (PT) and shall be free of cracks. If a welded gouge repair has been performed, magnetic particle testing (MT) shall be performed.
 - f. Web weld details: A minimum clear distance of $\frac{1}{2}$ " shall be provided between the weld access hole and fillet welds connecting the shear plate and beam web.
 - g. Welding for Moment Connection of Bottom Beam Flange shall be sequenced so as to minimize residual stresses in the joint
 - h. Weave Passes: Weave passes are not permitted in groove welds in the SLRS.
 - i. Column continuity plate details:
 - 1) If weld backing are used and remain in place, they shall receive a reinforcing fillet weld between the backing bar and column flange. No fillet weld should be placed between backing bar and continuity plate.
 - 2) Weld terminations near the end of the column flange tips may be completed using weld tabs. Weld tabs shall be removed. Conform to AWS D1.8 Sections 6.10.3 and 6.10.4. Following finishing, the edge shall be inspected using MT. Fillet weld terminations between the continuity plate and column web shall be approximately $\frac{1}{4}$ " from each end of the joint
 - j. Tack Welds in the SLRS Protected Zones: Tack welds in the SLRS Protected Zones are permitted only if they are incorporated into a required weld.
- E. Camber: Provide camber as indicated on contract drawings in accordance with AISC 360 Chapter M2.1.
- F. Welded Connectors: Install in accordance with AWS D1.1 and manufacturer's recommendations. There shall be no porosity or evidence of lack of fusion between the end of the stud and the steel member.
- G. Repair of Discontinuities in Protected Zone of Seismic-Load-Resisting System.
- 1. Repair of Discontinuities: If erection aids within the Protected Zone cannot be avoided,

the Structural Engineer's approval of the aid's placement, use, and the repair method is required. Conform to AWS D1.8 Section 6.15.4..

2. Air Carbon Arc Cutting and Thermal Cutting: Air carbon arc cutting (CAC-A) and thermal cutting is permitted in the Protected Zone with the prior approval of the Structural Engineer for the removal of weld backing and weld tabs, as specified in these documents.
3. Gouges in members and connections in the Seismic-Load-Resisting System shall be repaired according to the requirements of this Specification. Weld filler metal requirements for the Seismic-Load-Resisting System apply, unless otherwise noted.

H. Surface Finish

1. Flush Surfaces: Welds in butt joints required to be flush shall be finished so as to not reduce the thickness of the thinner base metal or weld metal by more than 1/16," or 5% of the material thickness, whichever is less. Remaining reinforcement shall not exceed 1/32" in height. However, all reinforcement shall be removed where the weld forms part of a faying or contact surface. All reinforcement shall blend smoothly into the plate surfaces with the transition areas free from undercut.
 2. Finish Methods and Values: Chipping and gouging may be used, provided these methods are followed by grinding. Where surface finishing is required, surface shall be Extra Smooth, unless otherwise noted or specified in this document. Measurement of surface finish values by visual appearance or tactile comparison is acceptable.
- I. Repair of Gouges: Gouges are not permitted in areas requiring an Extra Smooth finish surface, or where specifically prohibited by AWS D1.1 or this Specification. Repair of gouges meet the following requirements, unless otherwise noted:
1. Shallow Gouges: Gouges up to 3/16" deep shall be removed by grinding as per D1.1, or to a radius of not less than 3/8."
 2. Deep Gouges: Gouges deeper than 3/16" shall be repaired by welding. Prior to welding, gouges shall be ground to provide an Extra Smooth contour with a radius not less than 3/8." The repair area shall be preheated to a temperature between 400° F and 550° F, measured at the point of welding approximately one minute after removal of the heating source, or shall be preheated in accordance with AWS D1.1 Annex XI for high restraint. A written repair WPS for the application shall be followed. Following completion of welding, the area shall be ground Extra Smooth, with fairing of the welded surface to adjoining surfaces where applicable, and shall be inspected using magnetic particle testing (MT).
 3. The transitional slope after gouge removal shall not exceed 1:5.

2.04 FINISHES

- A. Walking Surfaces: walking surfaces shall be prepared to comply with OSHA requirements.
- B. Prime Painting
1. Surfaces to be painted:
 - a. Apply one coat of exterior primer to structural steel surfaces permanently exposed to weather.
 - b. Apply one coat of primer to AESS members and members to be painted unless otherwise noted.
 - c. Do not prime paint following surfaces:

- 1) Surfaces to be encased in concrete except initial 2."
 - 2) Surface to be field welded.
 - 3) Surface to receive sprayed-on fireproofing.
 - 4) Contact surfaces joined by high-strength bolts.
 2. Preparation of Surfaces:
 - a. Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from steel prior to painting.
 - b. Where hand-cleaning methods are inadequate, clean in accordance with SSPC-SP1, SSPC-SP 2, or SSPC-SP 7, as required.
 - c. Painting:
 - d. Apply primer in accordance with manufacturer's specifications to provide minimum dry film thickness of 1.0 mils per coat.
 - e. Permit thorough drying before shipment.
 - f. Do not prime in temperatures lower than 45 degrees Fahrenheit.
- C. Galvanization
1. Galvanize steel where required by the Drawings or by other sections of the Specification.
 2. Galvanize Shapes in accordance with ASTM A153.
 3. Galvanize Fasteners in accordance with ASTM B695, Class 40 minimum.
 4. Plug vent and drain holes in galvanized members with polyurethane cap sealed with silicone adhesive.

2.05 SOURCE QUALITY ASSURANCE

- A. The Owner's Testing Agency will:
1. Review ladle analysis and certificates of compliance. Where certification is questionable, test material to verify compliance.
 2. Inspect shop fabrication.
 3. Provide the management, personnel, equipment, and services required to perform the quality assurance functions required below.
 4. Verify that no improper attachments to the Protected Zone have been made.
- B. Welding Inspection: The Welding Inspector will perform the tasks indicated in the following list. This list shall not be considered exclusive of any additional inspection tasks that may be necessary to meet the requirements of AWS D1.1, CBC, and the Quality Assurance Plan
1. Review and understand the applicable portions of the specifications, the Contract Documents and the shop drawings for the project.
 2. Verify that all applicable welder qualifications, welding operator qualifications and tack welder qualifications are available, current, accurate, and in compliance with these specifications.
 3. Verify welder identification and qualification. Verify that any required supplemental welder qualification testing, if required for the joint, has been executed and that the welder has passed.
 4. Verify that each welder has a unique identification mark or die stamp to identify welds.
 5. Verify that all applicable Welding Procedure Specifications (WPSs), with Procedure Qualification Records (PQRs) as needed, are available, current and accurate, and comply with AWS D1.1 and this specification.
 6. Verify that an approved Welding Procedure Specification (WPS) has been provided and

that each welder performing the weld has reviewed the WPS. A copy of the appropriate WPS shall be available for each joint, although need not be present at each joint location.

7. Review mill test reports for all main member and designated connection base material for compliance with the project requirements.
8. Verify base material identification with the contract documents.
9. Verify the electrode, flux and shielding gas certifications for compliance with the Contract Documents.
10. Verify welding consumables with the approved WPSs.
11. Verify that electrodes are used only in the permitted positions and within the welding parameters specified in the WPS.
12. Verify that electrodes and fluxes are properly stored, and that exposure limits for the welding materials are satisfied.
13. At suitable intervals, observe joint preparation, assembly practice, preheat temperatures, interpass temperatures, welding techniques, welder performance and any post-weld controlled cooling and heat treatment to ensure that the requirements of the WPS and AWS D1.1 are satisfied.
14. At suitable intervals, verify current and voltage of the welding equipment in application of the WPS, if needed, by a calibrated amp and voltmeter. Current and voltage shall be measured near the arc with this equipment.
15. Inspect the work to ensure compliance with AWS D1.1 and the specified weld acceptance criteria.
16. Schedule NDT technicians in a timely manner, after the visual inspection is complete and the assembly has cooled. The final NDT on a specific weld shall be performed at least 24 hours after the welding has been completed.
17. Mark the welds, parts, and joints that have been inspected, and accepted, with a distinguishing mark or die stamp, or maintain records indicating the specific welds inspected and accepted by each inspector.
18. Document the accepted and rejected items in a written report. Transmit the report to the designated recipients in a timely manner.

C. Nondestructive Testing of Welded Joints

1. Magnetic Particle Testing: Magnetic Particle Testing (MT) shall be conducted by the Owner's Testing Agency at the frequency designated in Table 2-1. MT shall be performed in accordance with AWS D1.1, and AWS D1.8 Annex F.
2. Ultrasonic Testing: Ultrasonic testing (UT) shall be conducted by the Owner's Testing Agency for the percentage of joints designated in Table 2-1. UT shall be performed in accordance with AWS D1.1.
3. Weld Acceptance Criteria shall be in accordance with AWS D1.1. Regions of welds that cannot be inspected shall be identified and recorded, and the Structural Engineer shall be notified.
4. K-Area Welding Inspection: After welds of continuity plates, doubler plates, and EBF Link Stiffeners have cooled to ambient temperature, test column webs for cracking using liquid penetrant (PT) or magnetic particle testing (MT) over a zone 3" above and below each weld.

Table 2-1: Nondestructive Testing Requirements

Weld Category	Nondestructive Testing Requirements

	Complete-Joint-Penetration Welds ¹	Partial-Joint-Penetration Welds and Fillet Welds
Welds not described below	No NDT required unless otherwise noted	No NDT required unless otherwise noted
SLRS welds not described below	MT 25% of joints, full length ² UT 25% of joints, full length ²	MT 25% of joints, 6" spot at random ²
Top-flange joints at cantilever beam connections ³ Splices in beam flanges	MT 100% of joints, full length UT 100% of joints, full length	MT 100% of joints, full length
Demand-Critical Welds; Butt joints in SLRS column splices	MT 100% of joints, full length UT 100% of joints, full length ⁴	MT 100% of joints, full length

Notes:

1. UT is required only when the weld thickness is $\frac{5}{16}$ " or greater.
2. If any joint fails testing, test 100% of joints until 40 consecutive welds pass. The testing rate may then be reduced to 25%.
3. Test joint on each side of cantilever beam support.
4. Reduce the rate of UT to 25% if after 40 welds have been inspected, an individual welder's reject rate is less than 5%.

PART 3 - EXECUTION**3.01 INSPECTION**

- A. Examine units of Work to be placed and verify that all anchor rods have been installed properly and have sufficient bolt and thread elevation.
- B. Do not begin erection before unsatisfactory conditions have been corrected.

3.02 ERECTION

- A. General Requirements:
 1. Erect structural steel in accordance with AISC 360 Chapter M, AISC 303, and AWS D1.1 Structural Steel Welding Code as applicable to Statically Loaded Structures.
 2. Requirements for bolted and welded joints specified in Part 2 of this Specification shall also apply to field connections unless otherwise noted.
 3. Erection Tolerances: Do not exceed the erection tolerances specified in AISC 303, Section 7. Where more restrictive tolerances are necessary to properly install other building systems and components then adopt the more restrictive tolerances.
 4. Where erection requires performing work of fabrication on site, conform to applicable standards for fabrication.
 5. Architecturally Exposed Structural Steel (AESS): All structural steel denoted "AESS" on the drawings shall be erected in accordance with the requirements of Section 10 of AISC 303 as modified by Specification Section 05125.

- B. Anchor rods shall be set in conformance with Section 7.5 of AISC 303.
- C. Field Cutting or Alteration: There shall be no field cutting, alteration, or repair of structural steel members or of connections without prior review and approval by the Architect. Structural elements with fabrication errors or that do not satisfy tolerance limits shall be repaired. Submit drawings showing reasons for, and details of, proposed corrective work.
- D. Temporary Shoring and Bracing: Provide shoring and bracing as needed until permanent lateral-support is in place and complete. Contractor is responsible for identifying the need for temporary shoring and bracing.
- E. Erection Procedures: Control erection procedures and sequences to avoid problems caused by temperature differentials and weld shrinkage, and other sources of expansion and contraction.
- F. Field Assembly:
 - 1. Clean bearing surfaces and surfaces to be in permanent contact before assembling members.
 - 2. Do not fasten splices of columns and other members with bearing joints designated on the drawings before abutting surfaces have been brought completely into contact.
 - 3. Bolted Construction:
 - a. Installation of high-strength bolts shall conform to ASTM A325 for slip-critical or snug-tightened type joints, as applicable, in accordance with AISC 348. Provide washer under head or nut of high strength bolts. Washer shall be provided under the element being turned during tightening. Bolts in welded connections shall be tensioned after completion of welding.
 - b. At bolted joints designated as Slip-Critical or that require Pretension, use Twist-off-Type Tension-Control bolt assemblies or Direct Tension Indicators.
 - c. Do not use flame cutting to align bolt holes except as permitted by AISC 348 specifications. Ream holes that must be enlarged to admit bolts. Do not enlarge holes to a diameter greater than 1." When reaming beyond 1/32," drill or ream to the next larger hole size and use the next larger size bolt.
 - 4. Mill scale shall be removed from the column in the area where the beam flanges will be welded to the column.
- G. Gas Cutting: Use of flame cutting torch will be permitted only after the Architect's prior written approval and only where metal cut will not carry stress during cutting, and cut surfaces will not be visible. When thermal cutting is permitted, cutting shall be done with a mechanically guided torch or a torch controlled using a guide bar.
- H. Field Touch-Up Painting: After erection, touch-up paint field connections and abrasions resulting from the Work of this Section with same paint used for shop prime painting.
- I. Remove and repair galvanized surface as required for field welding in accordance with ASTM-A780, A2; required thickness is 100 micro-inches. Touch up with zinc-rich coating. Repair material shall extend at least three inches beyond edges of damaged areas.
- J. Protected Zone: Attachments to structural steel in the Protected Zone, other than spot welding of metal deck to beams, are not allowed.

3.03 CLEANING

- A. After erection, thoroughly clean surfaces of foreign or deleterious matter such as dirt, mud, oil, or grease that would impair bonding of fireproofing, concrete, or other finishes as applicable.
- B. Architecturally Exposed Structural Steel (AESS).
 - 1. If temporary braces or erection clips are used, remove braces and clips in a manner which prevents unsightly surfaces.
 - 2. Tack welds shall be ground smooth.
 - 3. Holes shall be filled with weld filler metal or body solder and ground smooth.
 - 4. All operations shall be performed such that the close fit and neat appearance of the structure will not be impaired.

3.04 FIELD QUALITY ASSURANCE

- A. The Owner's Testing Agency will:
 - 1. Verify proper anchor rod group location, elevation, and orientation prior to placement of concrete foundations, and again subsequent to placement of concrete foundations prior to arrival of structural steel.
 - 2. Verify proper anchor rod group location, elevation, and orientation subsequent to placement of concrete foundations prior to arrival of structural steel.
 - 3. Perform field welding inspection and testing in accordance with the requirements in Part 2 of this Specification for shop fabrication, unless otherwise noted.
 - 4. Inspect and test high strength bolted joints in accordance with AISC 348.
 - 5. Sample and test bolt assemblies that include direct tension indicators, on a daily basis to verify proper indication of deformation with required bolt tension for each size and lot.
 - 6. Inspect erected structural steel as required to establish conformity of Work with reviewed shop drawings and Contract Drawings.
 - 7. Perform testing and inspection of welded stud connectors in accordance with requirements of AWS D1.1. After the bend test, the weld section shall not exhibit any tearing or cracking.
 - 8. Inspect structural steel to verify that the Protected Zones of members of the Seismic-Load-Resisting System are free of damage and attachments not approved by the Structural Engineer.
 - 9. Forward copies of all test and inspection reports to the Owner, Architect, Structural Engineer, and, Contractor, and the Building Department.

END OF SECTION

SECTION 05 12 13

ARCHITECTURALLY EXPOSED STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Section.
- B. This Section includes requirements regarding the appearance and surface preparation of Architecturally Exposed Structural Steel (AESS).
- C. This Section applies to any members noted on Architectural and Structural Drawings as (AESS) and in the areas defined as AESS below.
- D. Related Sections
 - 1. Section 05 12 00, Structural Steel
 - 2. Section 05 50 00, Metal Fabrications
 - 3. Section 09 90 00, Painting

1.02 SUBMITTALS

- A. General: Submit each item below according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product Data for each type of product specified.
- C. Shop Drawings detailing fabrication of AESS components.
 - 1. Provide erection drawings clearly indicating which members are considered as AESS members.
 - 2. Include details that clearly identify all of the requirements listed in Article 2.03 Fabrication and Article 3.03 Erection of this specification. Provide connections for exposed AESS consistent with concepts shown on the Architectural or Structural Drawings.
 - 3. Indicate welds by standard AWS Symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined herein.
 - 4. Indicate type, size, finish and length of bolts distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections. Bolt head orientation shall be coordinated with the Architect.
 - 5. Clearly indicate which surfaces or edges are exposed and what class of surface preparation is being used.
 - 6. Indicate special tolerances and erection requirements as noted on the drawings or defined herein.

- D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of Architects and Owners, and other information specified. For each project, submit photographs showing detail of installed AESS as required by the Architect.

1.03 QUALITY ASSURANCE

- A. Fabricator Qualifications: In addition to those qualifications listed in Section 05 12 00, Structural Steel, engage a firm experienced in fabricating AESS similar to that indicated for this Project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the Work.
- B. Erector Qualifications: In addition to those qualifications listed in Section 05 12 00, Structural Steel, engage an experienced Erector who has completed AESS work similar in material, design and extent to that indicted for this Project and with a record of successful in-service performance.
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC Code of Standard Practice, latest edition Section 10 as amended herein.
- D. Mockups: At least four weeks prior to fabricating AESS, the Contractor shall construct mockups to demonstrate aesthetic effects as well as qualities of materials and execution. A mockup for each of the following elements shall be constructed: Build mockups to comply with the following requirements, using materials indicated for final unit of Work:
 - 1. Locate mockups on-site or in the fabricator's shop as directed by Architect. Mockups shall be full-size pieces unless the Architect approves smaller models.
 - 2. Notify the Architect one week in advance of the dates and times when mockups will be available for review.
 - 3. Demonstrate the proposed range of aesthetic effects regarding each element listed under the fabrication heading below.
 - 4. Mockup will have finished surface (including surface preparation and paint system).
 - 5. Obtain Architect's approval of mockups before starting fabrication of final units.
 - 6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
 - a. Approved mockups in an undisturbed condition at the time of Substantial completion may become part of the completed work.
- E. Pre-installation Conference: The General Contractor shall schedule and conduct conference at the project site to comply with requirements of Division 01 Section "Project Meetings." As a minimum the meeting shall include the General Contractor, Fabricator, Erector, the finish-painting subcontractor, and the Architect. Coordinate requirements for shipping, special handling, attachment of safety cables and temporary erection bracing, touch up painting and other requirements for AESS.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver AESS to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.
- C. Erect pre-painted finish pieces using padded slings or other methods such that they are not damaged. Provide padding as required to protect while rigging and aligning member's frames. Weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where approved by the Architect during the pre-installation meeting. Methods of removing temporary erection devices and finishing the AESS members shall be approved by the Architect prior to erection.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1.06 COORDINATION

- A. Coordinate installation of anchors for AESS members that connect to the work of other trades. Furnish setting drawings, templates, and directions for installing anchors, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the project site in time for installation.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. General: Meet requirements in Section 05 12 00 Structural Steel. As amended below.
- B. High Strength Bolts, Nuts and Washers: Per Section 05 12 00 heavy hex heads and nuts. Provide standard carbon steel finish.

2.02 PRIMERS

- A. Compatibility: The General Contractor shall submit all components/procedures of the paint system for AESS as a single coordinated submittal. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable) and finish coat. All of the items shall be coordinated with the finish coat specified in Division 09.
- B. Primer: Fast curing, universal modified alkyd, rust inhibiting shop coat with good resistance to normal atmospheric corrosion. Primer shall comply with all federal standards for VOC, lead and chromate levels.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for galvanizing welds and repair-painting galvanized steel, with dry-film coating not less than 90 percent zinc dust by weight.

2.03 FABRICATION

- A. Fabricate and assemble AESS in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by the Architect. Detail AESS assemblies to minimize field handling and expedite erection.
- B. Fabricate AESS with exposed surfaces smooth, square and of surface quality consistent with the approved mock up. Use special care in handling and shipping of AESS both before and after shop painting.
- C. In addition to special care used to handle and fabricate AESS, employ the following fabrication techniques:
 - 1. Fabrication Tolerance: Fabricate steel to one half of the normal tolerance as specified in the Code of Standard Practice Section 10.
 - 2. Welds ground smooth: Fabricator shall grind welds of AESS smooth. For groove welds, the weld shall be made flush to the surfaces each side and be within + 1/16", -0" of plate thickness.
 - 3. Contouring and blending of welds: Where fillet welds are indicated to be ground, contoured, or blended, oversize welds as required and grind to provide smooth transition and to match profile on approved mock-up.
 - 4. Continuous Welds: Where welding is noted on the drawings, provide continuous welds of a uniform size and profile.
 - 5. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
 - 6. Coping and Blocking Tolerance: Maintain a uniform gap of $1/8" \pm 1/32"$ at all copes and blocks.
 - 7. Joint Gap Tolerance: Maintain a uniform gap of $1/8" \pm 1/32"$.
 - 8. Piece Marks Hidden: Fabricate such that piece marks are fully hidden in the final structure or made with such media to permit full removal after erection.
 - 9. Mill Mark Removal: Fabricator shall deliver steel with no mill marks (stenciled, stamped, raised etc.) in exposed locations. Mill marks shall be omitted by cutting of mill material to appropriate lengths where possible. Where not possible, the fabricator can fill and / or grind to a surface finish consistent with the approved mock up.
 - 10. Grinding of sheared edges: Fabricator shall grind all edges of sheared, punched or flame cut steel to match approved mockup.

11. Rolled Members: Member specified to be rolled to a final curved shape shall be fully shaped in the shop and tied during shipping to prevent stress relieving. Distortion of the web or stem, and of outstanding flanges or legs of angles shall be visible acceptance to the Architect from a distance of 20' under any lighting condition determined by the Architect. Tolerances for the vertical and horizontal walls of rectangular HSS members after rolling shall be the specified dimension $\pm 1/2"$.
12. Seal weld open ends of round and rectangular hollow structural section with 3/8" closure plates. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where AECS is exposed to weather.

2.04 SHOP CONNECTIONS

- A. Bolted Connections: Make in accordance with Section 05 12 00. Provide bolt type and finish as noted herein and align bolt heads as indicated on the approved shop erection drawings.
- B. Weld Connections: Comply with AWS D1.1 and Section 05 12 00. Appearance and quality of welds shall be consistent with the mock up. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding tolerance of this section.

2.05 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".
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections, if primer does not meet the specified AISC slip coefficient.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC Specifications as follows:
 1. SSPC-SP 1 "Solvent Cleaning"
 2. SSPC-SP 2 "Hand Tool Cleaning" (This level of surface preparation will not be adequate for most paint systems for AECS Construction.)
 3. SSPC-SP 3 "Power Tool Cleaning" (This level of surface prep is the minimum for most AECS projects. It may be acceptable for alkyd primers and acrylic or alkyd finish coats, particularly in interior applications.)
 4. SSPC-SP 6 "Commercial Blast Cleaning" (This level of surface prep adds significantly to the total cost of the steel. It is required for epoxy primers to allow adequate bonding to the steel. Recommended for locations where a rust inhibitive primer will be used in an exterior application. It is also required where polyurethane finish coats will be used over the primer.)
 5. Coordinate the required blast profile with the approved paint submittal prior to beginning surface preparation.
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils (0.038 mm). 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 primer to surfaces that are inaccessible after assembly or erection.

2.06 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to AESS indicated for galvanizing according to ASTM A123. Fabricate such that all connections of assemblies are made in the field with bolted connections. Provide galvanized finish on members and assemblies within the range of color and surface textures presented in the mock ups.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. The erector shall check all AESS members upon delivery for twist, kinks, gouges or other imperfections which might result in rejection of the appearance of the member. Coordinate remedial action with fabricator prior to erecting steel.

3.02 PREPARATION

- A. Provide connections for temporary shoring, bracing and supports only where noted on the approved shop drawings. Temporary connections not shown shall be made at locations not exposed to view in the final structure or as approved by the Architect. Handle, lift and align pieces using padded slings and/or other protection required to maintain the appearance of the AESS through the process or erection.

3.03 ERECTION

- A. Set AESS accurately in locations and to elevations indicated, and according to AISC specifications referenced in this Section.

In addition to the special care used to handle and erect AESS, employ the following erection techniques:

1. AESS Erection Tolerances: Erection Tolerances shall meet the requirements of Chapter 10 of the AISC Code of Standard Practice.
2. Welds ground smooth: Erector shall grind welds smooth in the connections of AESS members. For groove welds, the weld shall be made flush to the surfaces of each side and be within + 1/16", -0" of plate thickness.
3. Contouring and blending of welds: Where fillet welds are indicated to be ground contoured, or blended, oversize welds as required; grind to provide a smooth transition and to match profile on approved mock-up.
4. Continuous Welds: Where noted on the drawings, provide continuous welds of a uniform size and profile.

5. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
6. Bolt Head Orientation: All bolt heads shall be oriented as indicated on the contract documents. Where bolt-head alignment is specified, the orientation shall be noted for each connection on the erection drawings. Where not noted, the bolt heads in a given connection shall be oriented to one side.
7. Removal of field connection aids: Run-out tabs, erection bolts and other steel members added to connections to allow for alignment, fit-up, and welding in the field shall be removed from the structure. Field groove welds shall be selected to eliminate the need for backing bars or to permit their removal after welding. Welds at run-out tabs shall be removed to match adjacent surfaces and ground smooth. Holes for erection bolts shall be plug welded and ground smooth.
8. Filing of weld access holes: Where holes must be cut in the web at the intersection with flanges on W shapes and structural tees to permit field welding of the flanges, they shall be filled. Filling shall be executed with proper procedures to minimize restraint and address thermal stresses in group 4 and 5 shapes.
9. Filed welding: Weld profile, quality, and finish shall be consistent with mock-ups approved prior to fabrication.
10. Splice members only where indicated.
11. Obtain permission for any torch cutting or field fabrication from the Architect. Finish sections thermally cut during erection to a surface appearance consistent with the mock up.
12. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.

3.04 FIELD CONNECTIONS

- A. Bolted Connections: Install bolts of the specified type and finish in accordance with Section 05 12 00 Structural Steel.
- B. Welded Connections: Comply with AWS D1.1 for procedures, and appearance. Refer to Section 05 12 00 Structural Steel for other requirements.
 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp. Verify that weld sizes, fabrications sequence, and equipment used for AESS will limit distortions to allowable tolerances.
 2. Obtain Architects approval for appearance of welds in repaired or field modified work.

3.05 FIELD QUALITY CONTROL

- A. Structural requirements: The Owner will engage an independent testing and inspecting agency to perform field inspections and test and to prepare test reports. Refer to Section 05 12 00 Structural Steel for detailed bolt and weld testing requirements.
- B. AESS acceptance: The Architect shall observe the AESS steel in place and determine acceptability based on the mockup. The testing Agency shall have no responsibility for enforcing the requirements of this Section.

3.06 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint shall be completed to blend with the adjacent surfaces of AESS. Such touch up work shall be done in accordance with manufacturer's instructions as specified in Section 09 90 00 Painting.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

SECTION 05 45 00**METAL SUPPORT ASSEMBLIES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Furring for support of gypsum board.
 - 2. Suspended framing system for interior suspended ceilings.
 - 3. Backing for interior items to be attached to gypsum board.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 07 92 00 - Joint Sealants: Provision of acoustical sealant.
 - 2. Section 09 29 00 - Gypsum Board: Provision of gypsum board.

1.02 REFERENCES

- A. AISI - American Iron and Steel Institute
 - 1. North American Specification for the Design of Cold-formed Steel Structural Members.
- B. ASTM - American Society for Testing and Materials
 - 1. A568 - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
 - 2. A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 3. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 4. C645 - Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
 - 5. C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
 - 6. E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- C. AWS - American Welding Society
 - 1. D1.3 - Structural Welding Code - Sheet Steel
- D. CBC - California Building Code, 2022 Edition
- E. GA - Gypsum Association
 - 1. 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.
- F. ICC - International Code Council
- G. SSMA - Steel Stud Manufacturers Association
- H. USG - United States Gypsum Company
 - 1. Drywall/Steel Framed Systems, SA923/rev. 3-02.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements
 - 1. Plumb, true, straight and rigid framing for support of attached materials.
 - 2. Design system to accommodate construction tolerances, deflection of building structural members, support of attached materials and clearances of intended openings in accordance with CBC.
 - 3. Gypsum board ceilings shall not support materials or building components other than grilles, light fixtures, small electrical conduits and small ducts. Such components shall be supported by supplemental framing which is supported by main runners. No vertical loads other than gypsum board dead load shall be applied to cross-furring.

1.04 SUBMITTALS

- A. Product Data: For each type of metal framing product and accessory indicated, including manufacturer's typical details, ICC report, specifications and installation instructions.

1.05 QUALITY ASSURANCE

- A. Welder Qualifications: Qualified in accordance with AWS D1.3 for welding process, position, type of weld and type of steel.
- B. Regulatory Requirements
 - 1. Comply with fire resistance ratings as indicated and as required by governing authorities and codes.
 - 2. Provide materials, accessories, and application procedures that have been listed by an approved testing agency or tested according to ASTM E119 for the type of construction shown.
- C. Perform work in accordance with GA 203 and ASTM C754, governing laws, building code requirements, manufacturer's printed recommendations and USG's "Drywall/Steel Framed Systems, SA923/rev. 3-02."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection
 - 1. Deliver materials to job site and store in ventilated dry locations. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather.
 - 2. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

PART 2 - PRODUCTS**2.01 MANUFACTURER**

- A. Acceptable Manufacturers
 - 1. Steel Framing and Furring: Member of SSMA (ICC ER-4943P).
 - 2. Grid Suspension Assemblies: Chicago Metallic Corp.; USG Interiors, Inc.; National Rolling Mills Co., or approved equal.

2.02 STEEL FRAMING FOR FURRING

- A. Furring and Bracing Members: Sheet steel, ASTM A653, thickness to suit purpose.

- B. Steel Rigid Furring Channels: ASTM C645, hat shaped, depth of 7/8-inch, and minimum thickness of base (uncoated) metal as follows:
 - 1. Thickness: 0.0179-inch, unless otherwise indicated.
 - 2. Protective Coating: ASTM A653, G 40 hot-dip galvanized coating.
- C. Z-Furring Members: Manufacturer's standard Z-shaped furring members with slotted or nonslotted web, fabricated from steel sheet complying with ASTM A568 or ASTM A653; with a minimum base metal (uncoated) thickness of 0.0179-inch, face flange of 1-1/4 inch, wall-attachment flange of 7/8-inch, and of depth required to fit insulation thickness indicated.
- D. Resilient Channels: As manufactured by Unimast, "RC Deluxe"; Cemco, "RC-1"; Dale/Incor, "RFC-1", or approved equal.
- E. Hat Channels: Hat-shaped, corrosion-resistant rigid furring channels, ASTM C645, 7/8-inch deep unless otherwise indicated, base metal thickness as required, as manufactured by Dietrich Metal Framing, Inc., "FC-Series", or approved equal.
- F. Metal Screws: Self-drilling and self-tapping; No. 8 and larger as noted on the Drawings; ITW Buildex, "TEKS (ICC ESR-1976)", or approved equal; screws shall penetrate substrate by a minimum of 3 full threads exposed; use low profile heads as required by architectural finish.
- G. Powder Driven Fasteners
 - 1. Tempered steel pins with special corrosive resistant plating or coating.
 - 2. Pins shall have guide washers to accurately control penetration.
 - 3. Fastening shall be accomplished by low-velocity, piston-driven, powder accentuated tool.
 - 4. Pins and tool shall be Hilti, "X-U Fasteners (ICC ESR 1385)", or approved equal.
- H. Expansion Bolts: Hilti Fastening Systems, "Kwik Bolt TZ Concrete Anchors (ICC ESR-1917)", or approved equal.
- I. Metal Backing Plates: As indicated on the Drawings.
- J. Bracing: Provide cross diagonal straps, attached as indicated on the Drawings and per stud manufacturer's specifications for frame stability.
- K. Welding Electrodes: AWS low hydrogen; rod number and diameter as approved by Owner's Testing Agency.

2.03 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

- A. General: Provide components of sizes indicated but not less than that required to comply with CBC and ASTM C754 for conditions indicated.
- B. Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft temper, with gauge in accordance with CBC.
- C. Angle-Type Hangers: Angles with legs not less than 7/8-inch wide, formed from 0.0635-inch thick galvanized steel sheet complying with ASTM A653, G90 Coating Designation, with bolted connections and 5/16-inch diameter bolts.
- D. Channels: Cold-rolled steel, 0.0598-inch minimum thickness of base (uncoated) metal and 7/16-inch wide flanges, and as follows:
 - 1. Carrying Channels: 1-1/2 inches deep, 1.12 pound/foot minimum, hot rolled.

2. Furring Channels: 7/8-inch deep, 26 gauge, galvanized hat sections at 24 inches maximum center to center.
 3. Finish: ASTM A653, G60 hot-dip galvanized coating where indicated.
- E. Steel Studs for Furring Channels: ASTM C645, with flange edges bent back 90 degrees and doubled over to form 3/16-inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:
1. Thickness: 0.0179 inch, unless otherwise indicated.
 2. Depth: 1-5/8 inch, unless otherwise indicated.
 3. Protective Coating: ASTM A653, G40 hot-dip galvanized coating for framing for ceiling suspension members in areas within 10 feet of exterior walls.

2.04 MISCELLANEOUS MATERIALS

- A. Acoustical Sealant: As specified in Section 07 92 00.
- B. Galvanized Finish Touch-Up Coating: Liquid zinc compound that bonds electrochemically to iron, steel and aluminum, as manufactured by ZRC Chemical Products, "ZRC Cold Galvanizing Compound", or approved equal.

2.05 FINISHES

- A. Galvanized Surfaces: Where galvanizing is removed by welding or other assembly procedures, clean area of any foreign matter by wire brushing and metal conditioner recommended by galvanized finish touch-up manufacturer. Apply galvanized touch-up coating by brush or spray with minimum coverage of 1.4 mils, dry film.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive metal support framing systems and verify the following:
1. Installation of building components located in walls is complete.
 2. Backing plates are properly located for support of wall hung items.
- B. Beginning of installation means installer accepts existing conditions.

3.02 INSTALLING STEEL FRAMING FOR FURRING

- A. Backing in Studs or Furring
1. Verify that any pre-drilling of backing and attachment of spacers to prevent crushing of attached material is done prior to application of attached material.
 2. Securely weld or screw cut sections of unpunched stud to at least 3 studs or furring supports, leaving flat surface of backing stud web to receive attachment of object to be secured.
 3. If it is determined by the Architect that backing was not provided for any items as required, the Contractor shall remove the finish materials; install backing and shall patch and refinish surface to match adjacent area and surface at no additional cost to the Owner.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8-inch from plane of faces of adjacent framing.

3.03 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

- A. Suspend ceiling hangers from building structural members and as follows:
1. Hangers shall be saddle-tied around main runners to develop full strength of hangers.
 2. Cross-furring shall be saddle-tied to main runners with 1 strand of No. 16 or 2 strands of No. 18 gauge tie wire.
 3. Main runners shall be spliced by lapping and interlocking flanges 12 inches minimum and tying near each end with double loops of No. 16 gauge wire.
 4. Cross-furring shall be spliced by lapping and interlocking the pieces 8 inches minimum and tying near each end with double loops of No. 16 gauge wire.
 5. Fasten hanger wires with not less than 3 tight turns. Fasten bracing wires with 4 tight turns. Make all tight turns within a distance of 1-1/2 inches. Hanger or bracing wire anchors to the structure shall be installed in such a manner that the direction of the wire aligns as closely as possible with direction of the forces acting on the wire.
 - a. Wire turns made by machine where both strands have been deformed or bent in wrapping can waive the 1-1/2 inch requirement, but the number of turns shall be maintained, and be as tight as possible.
 6. Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, and conduit.
 7. Provide trapeze or other supplementary support members at obstructions to main hanger spacing.
 8. Provide additional hangers, struts or braces as required at all ceiling breaks or discontinuous areas.
 9. Hanger wires that are more than 1 in 6 out of plumb shall have counter-sloping wires.
- B. Light Fixture Support
1. Recessed or drop-in light fixtures shall be supported directly by main runners or by supplemental framing which is supported by main runners.
 2. Surface mounted fixtures shall be attached to main runner by positive clamping device made of material with a minimum of 14 gauge. Rotational spring catches do not comply.
 3. Light fixtures, HVAC diffusers, speakers, etc., shall have minimum 2 wires at opposite ends for support if ceiling should fail during seismic fault.
- C. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring members or grid suspension members are level to within 1/8-inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.

3.04 FIELD QUALITY CONTROL

- A. The Owner's Testing Agency will provide periodic inspection of welding, including prior fit-up welding equipment, weld quality, and welder certification in accordance with AWS and CBC.

END OF SECTION

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SECTION 05 50 00**METAL FABRICATIONS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Stainless steel mesh infill between galvanized steel guardrails, pre-finished for spray booth powder coating, as indicated on the Drawings.
 - 2. Brake metal panels pre-finished to match roofing and siding panels, as specified in Section 07 40 00, where indicated on the Drawings.
 - 3. Corrugated Corten fence as indicated on the Drawings.
 - 4. Corten planters as indicated on the Drawings.
 - 5. Countertop supports.
 - 6. Non-structural miscellaneous metal channels, angle imbeds, and other shapes as required.
 - 7. Rough hardware.
 - 8. Alternate #1: Provide new South Deck, including fire retardant-treated 4x4 lpe wood, as specified in Section 06 20 00, over galvanized painted steel structure and railings, as specified herein.
 - 9. Alternate #3: Provide additional footage at new South Deck, including fire retardant-treated 4x4 lpe wood, as specified in Section 06 20 00, over galvanized painted steel structure and railings, as specified herein.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Division 01 - General Requirements: For alternates.
 - 2. Section 06 20 00 - Finish Carpentry: Provision of lpe wood deck.
 - 3. Section 07 40 00 - Roofing and Siding Panels: Provision of metal panels at exterior.
 - 4. Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of sheet metal flashing and trim.
 - 5. Section 08 11 16 - Aluminum Doors and Frames: Provision of aluminum doors and frames.
 - 6. Section 09 90 00 - Painting and Coating: For finish painting of items not specified to have factory finish.
 - 7. Section 12 36 61.16 - Solid Surfacing Countertops: Provision of solid surfacing countertops.

1.02 REFERENCES

- A. AISI - American Institute of Steel Construction Inc.
- B. ANSI - American National Standards Institute
 - 1. B18.6.3 - Machine Screws and Machine Screw Nuts.
 - 2. B18.21.1 - Lock Washers (Inch Series).
 - 3. B18.22.1 - Plain Washers.
- C. ASTM - American Society for Testing and Materials
 - 1. A27 - Standard Specification for Steel Castings, Carbon, for General Application.
 - 2. A36 - Standard Specification for Carbon Structural Steel.
 - 3. A47 - Standard Specification for Ferritic Malleable Iron Castings.
 - 4. A48 - Standard Specification for Gray Iron Castings.

5. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 6. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 7. A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 8. A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 9. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 10. A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 11. A563 - Standard Specification for Carbon and Alloy Steel Nuts.
 12. A606 - Standard Specification for Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High-Strength, Low-Alloy, with Improved Corrosion Resistance.
 13. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 14. A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 15. A786 - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
 16. B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 17. C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch Cube Specimens).
 18. C157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.
 19. C191 - Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
 20. D1187 - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 21. E488 - Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
 22. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
 23. F594 - Standard Specification for Stainless Steel Nuts.
- D. AWS - American Welding Society
1. D1.1 - Structural Welding Code - Steel.
 2. D1.3 - Structural Welding Code - Sheet Steel.
 3. D1.6 - Structural Welding Code - Stainless Steel.
- E. CBC - California Building Code, 2022 Edition
- F. NAAMM - National Association of Architectural Metal Manufacturers
1. MFM - Metal Finishes Manual for Architectural and Metal Products.
- G. SSPC - The Society for Protective Coatings
1. PA 1 - Shop, Field, and Maintenance Painting of Steel.
 2. SP 2 - Hand Tool Cleaning.
 3. SP 3 - Power Tool Cleaning.
 4. SP 6 - Commercial Blast Cleaning.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements
1. Design work to support normally imposed loads and in conformity with AISI requirements.

2. Provide for expansion and contraction.
3. Structural Performance of Guardrails, Handrails, and Railings: Provide guardrails, handrails, and railing systems that shall withstand structural loads without exceeding the allowable working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each of the respective components of each metal fabrication in accordance with CBC.
4. Shop drawings and calculations for metal fabrications engineered under work of this Section shall be prepared under direct supervision of State of California licensed Structural Engineer and shall be so wet stamped and wet signed.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for warning strips, paint products, and grout.
- B. Shop Drawings: Submit shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Quality Control Submittals: Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

1.05 QUALITY ASSURANCE

- A. Welding Standards: Comply with applicable provisions of AWS D1.1, AWS D1.3, and AWS D1.6.
 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Steel and Iron
 1. Steel Plates, Shapes, and Bars: ASTM A36.
 2. Rolled Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.
 3. Cold-Formed Steel Tubing: ASTM A500.
 4. Hot-Formed Steel Tubing: ASTM A501.
 5. Steel Pipe: ASTM A53, Type S, Grade B, Schedule 40, unless otherwise indicated, or another weight required by structural loads.
 - a. Black finish, unless otherwise indicated.
 - b. Prime with red oxide primer at locations detailed to receive paint.
 6. Corten (Weathering) Steel: ASTM A606, Type 4, high-strength, low-alloy steel designed to form a stable, rust-like, protective patina when exposed to the elements, eliminating the need for painting.
 7. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 304.
 8. Stainless Steel Wire Mesh: Type 304, woven, rigid cable-style weave, 65 percent open area, mill finish, as manufactured by McNichols, "AURA 8150", or approved equal.

9. Gray-Iron Castings: ASTM A48, Class 30.
 10. Malleable-Iron Castings: ASTM A47, grade as recommended by fabricator for type of use indicated.
- C. Concrete Inserts: Anchors of type indicated below, fabricated from corrosion resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
1. Threaded or wedge type; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized in accordance with ASTM A153.
 2. Provide weld plate imbedded in concrete as detailed in the Drawings. Coordinate location with other imbedded materials.
- D. Fasteners: Provide plated fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating, for use where built into exterior walls, concrete slabs, or ceilings. Select fasteners for the type, grade, and class required.
1. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A, with hex nuts, ASTM A563, and, where indicated, flat washers.
 2. Machine Screws: ANSI B18.6.3.
 3. Plain Washers: Round, carbon steel, ANSI B18.22.1.
 4. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.
 5. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
 - a. Material: Carbon steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.
 - b. Material: Group 1 alloy 304 or 316 stainless steel bolts and nuts complying with ASTM F593 and ASTM F594.
 6. Epoxy Cement: As manufactured by Simpson Strong-Tie, "SET/ET/AT High Strength Anchoring Adhesives", or approved equal.
- E. Welding Materials: AWS D1.1, AWS D1.3, and AWS D1.6, type required for materials being welded.
- F. Solid Surfacing Countertops: As specified in Section 12 36 61.16.

2.02 STANDARD CATALOG PRODUCTS

- A. Non-Shrink Grout
1. Premixed; containing no metallic particles, requiring only addition of water.
 2. Shall have minimum working time of 15 minutes and initial set time of 30 to 45 minutes in accordance with ASTM C191.
 3. Product: As manufactured by Master Builders Technologies, "Masterflow 928"; Five Star Products, Inc., "Five Star Grout 100", or approved equal.
- B. Expansion Cement
1. Non-metallic, non-corrosive, pourable hydraulic type cement that is quick-setting, high strength, and non-shrinking, with the following properties
 - a. Compressive Strength: 58,400 psi at 7 days in accordance with ASTM C109.
 - b. Volume Change: Plus 0.31 at 7 days in accordance with ASTM C157.
 2. Water: Potable.
 3. Product: As manufactured by Custom Building Products, "Pour-Stone"; Minwax Construction Products, "Por-Rok Anchoring Cement", or approved equal.

- C. Coatings
 - 1. Coatings for Protection of Dissimilar Materials: Bituminous type materials in accordance with ASTM D1187.
 - 2. Shop Primer for Ferrous Metal: VOC compliant, fast-curing, lead and chromate free, universal modified alkyd primer with good resistance to corrosion, compatible with finish paint systems.
 - 3. Galvanizing Repair Paint: High zinc dust content paint, with dry film containing not less than 94 percent zinc dust by weight, as manufactured by Parker Amchem, "Galvaprep SG"; Sherwin Williams, "Zinc Clad I", or approved equal.

2.03 FABRICATION, GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on Construction Drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
 - 1. Temperature Change (Range): 100 degrees Fahrenheit.
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. Weld corners and seams continuously 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 that no roughness shows after finishing and contour of welded surface matches those adjacent.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

- J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. 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.
- K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.04 GUARDRAILS, HANDRAILS, AND RAILINGS

- A. Steel
 - 1. General: Fabricate steel guardrails, handrails, and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube or pipe, post spacings, and anchorage, but not less than that required to support structural loads.
 - a. Tube Diameter: As indicated.
 - 2. Interconnect handrail and railing members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.
 - a. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe to which end is joined, and weld all around.
 - 3. Form changes in direction of handrails and railings as detailed.
 - 4. Form simple and compound curves by bending tube or pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of tube or pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
 - 5. Provide wall returns at ends of wall-mounted handrails as indicated.
 - 6. Close exposed ends of tube or pipe by welding 3/16-inch thick steel plate in place or with prefabricated fittings.
 - 7. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, post base flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of handrails and railing systems to other work. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete.
 - 8. Fillers: Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and overstressing of substrate.
 - 9. For galvanized handrails and railing systems, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

2.05 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
 - a. Except as otherwise indicated, space anchors 24 inches on center and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4-inch thick by 8 inches long.

- C. Galvanize miscellaneous interior framing and supports.

2.06 STEEL AND IRON FINISHES

- A. General: Comply with NAAMM's MFM for recommendations relative to applying and designing finishes. Finish metal fabrications after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Typical: SSPC SP 2, SSPC SP 3, as required.
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC PA 1 for shop painting.
- D. Powder Coating: Manufacturer's standard, with color as selected by the Architect.
- E. Finish Painting: As specified in Section 09 90 00.
- F. Stainless Steel Finishes
 - 1. Remove or blend tool and die marks and stretch lines into finish.
 - 2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - 3. Satin, Directional Polish: No. 6 finish.
 - 4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required. Fasteners not installed but required after pour shall be submitted to the Architect for approval. Fastener shall not be installed until the Architect approval is received.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- 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 the surfaces of units that have been galvanized after fabrication and are intended for bolted or screwed field connections.
- E. Field Welding
 - 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 that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.02 INSTALLING GUARDRAILS, HANDRAILS, AND RAILINGS

- A. Adjust guardrails, handrails, and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows
 1. Anchor posts to post tension concrete by welding directly to imbedded steel supporting members.
 2. Anchor handrail and post ends to cast-in-place concrete and masonry with drilled-in epoxy and bolt anchors as indicated on the Drawings.

3.03 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and prime and paint exposed areas with same material as used for shop painting to comply with SSPC PA 1 requirements for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a 2.0-mil minimum dry film thickness.
- B. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Section Includes: Provision of all lumber framing, rough hardware, blocking and backing as indicated in the contract drawings.

1.02 REFERENCES

- A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. The following published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work in this Section (latest editions apply).
 - 1. California Code of Regulations. Title 24, 2019 edition, also known as California Building Code (CBC).
 - 2. (APA) - American Plywood Association, "Guide to Plywood Grades."
 - 3. (PS) - United States Product Standard, PS-1 and PS-2 "Construction and Industrial Plywood."
 - 4. (UL) - Underwriters' Laboratories, Inc., "Fire Hazard Classification, FR-S."
 - 5. (WCLIB) - West Coast Lumber Inspection Bureau, "Standard Grading Rules No. 17."
 - 6. (WWPA) - Western Wood Products Association, "Grading Rules for Lumber."
 - 7. (AWPA) - American Wood Preservers Association Standards.
 - a. T1 – "Processing and Treatment Standard"
 - b. U1 – "User Specification for Treated Wood"
 - 8. (AF&PA) - American Forest and Paper Association, "National Design Specification for Wood Construction." "Special Design Provisions for Wood & Seismic."
 - 9. (ASTM) - American Society of Testing and Materials.

1.03 SUBMITTALS

- A. Shop Drawings of all specially fabricated rough hardware.
- B. Certification: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and

identifying grading agency, grade, species, moisture content at time of surfacing, and mil.

- C. Samples as requested by the architect.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Provide proper facilities for handling and storage of materials to prevent damage to edges, ends, and surfaces.
- B. Keep materials under cover and dry. Protect against exposure to moisture and contact with damp or wet surfaces. Where necessary, stack materials off ground on level flat forms, fully protected from weather.

1.05 JOB CONDITIONS

- A. Environmental Requirements: Maintain uniform moisture content of lumber at not more than 19-percent during and after installation.
- B. New lumber adjacent and connected to existing lumber shall have a moisture content of not more than 15 percent at the time of installation.
- C. Sequencing, Scheduling: Coordinate details with other Work supporting, adjoining or fastening to rough carpentry Work.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Rough Carpentry:
1. Sills on Concrete: Douglas Fir with Preservative Treatment.
 2. Lumber (Wood Framing): Meet requirements of following minimum grades.

<u>Item</u>	
Studs	D.F. No. 1
Plates	D.F. No. 1
Beams	D.F. No. 1
Joists	D.F. No. 1
Posts	D.F. No. 1
Blocking	D.F. No. 2
 3. Plywood: Provide thickness, grade, and panel identification index shown on drawings. For plywood thickness 5/32 or greater provide a minimum of 5 ply.
- B. Rough Hardware: All exterior hardware shall be hot-dipped galvanized.
1. Nails: Common wire per ASTM F1667, typical; hot-dipped zinc-coated galvanized, stainless steel, silicon bronze, or copper at exposed conditions, fire-retardant-treated, and preservative-treated lumber.
 2. Expansion Bolts: Reverse cone, self-wedging, expansion type, Tightening of nut or increased tension on bolt shank shall act to force wedges outward to

create positive increased resistance to withdrawal, Simpson Strong-Bolt, Hilti Kwik-Bolt TZ, or equal product substituted per Section 01 63 00.

3. Metal Framing Connectors: Fabricate from hot-dipped galvanized steel (G90 coating). Connectors in contact with preservative-treated lumber shall have G185 hot dipped galvanized coating per ASTM A653. Connectors in contact with fire-treated lumber or are in high corrosive environments shall be manufactured with Type 316L stainless steel. Connectors shall be at least 16-gauge material, 1/8-inch plate materials where welded, unless otherwise shown or specified, punched for nailing. Nails and nailing shall conform to the manufacturer's instructions, including coating and material where applicable, with a nail provided for each punched nail hole. Use maximum nail size listed by manufacturer. Manufactured by Simpson Company or equal product substituted per Section 01 63 00.
4. Miscellaneous Hardware: Provide all common screws, bolts, fastenings, washers and nuts required to complete rough carpentry Work.
5. Bolts and sill bolts in wood shall be ASTM A307 with standard cut threads; full diameter bolts (no rolled or "upset" threads permitted) per ANSI/ASME standard B18.2.1.
6. Fasteners used for attachment of exterior wall coverings shall be hot-dipped zinc-coated galvanized steel, mechanically deposited zinc-coated steel, stainless steel, silicon bronze, or copper. The coating weights for hot-dipped zinc-coated fasteners shall be in accordance with ASTM A153. The coating weights for mechanically deposited zinc-coated fasteners shall be in accordance with ASTM B695, Class 55 minimum.

2.02 TREATMENTS

- A. Fire-Retardant Treatment: Furnish in accordance with AWPA Standards T1, U1, and P17, "Fire Retardant Formulations."
- B. Preservative Treatment: Furnish in accordance with AWPA Standards T1 and U1. Preservatives with an ammonia base, including Ammoniacal Copper Zinc Arsenate (ACZA) are not permitted.

2.03 FABRICATION

- A. Preparation:
 1. Verify measurements at job site.
 2. Verify details and dimensions of equipment and fixtures integral with finish carpentry for proper fit and accurate alignment.
 3. Coordinate details with other work supporting, adjoining, or fastening to casework.
- B. Lumber:
 1. Air- or kiln-dry to maximum 19-percent moisture content at time of surfacing.

2. Furnish surfaced four sides, S4S, unless otherwise noted.
 3. Size to conform with rules of governing standard. Sizes shown are nominal unless otherwise noted.
- C. Wood Treatments:
1. Fire-Retardant Treatment:
 - a. Treat in accordance with AWPAs Standards T1 and U1 and approved manufacturer's recommendations. Verify AWPAs Use Category with proposed application prior to selected preservative. Fire treated lumber shall conform to the requirements of CBC Section 2303.2.
 2. Preservative Treatment:
 - a. Treat lumber and plywood sheathing that is:
 - i. In contact with concrete and masonry less than six feet above the ground.
 - ii. Exposed to weather permanently.
 - iii. Where specified in the Contract Documents.
 - b. Treat in accordance with AWPAs Standards T1 and U1. Verify AWPAs Use Category with proposed application prior to selecting preservative.
 - c. Treated lumber shall be marked per CBC Section 2303.1.8.1.
 - d. After Treatment and prior to shipping, air- or kiln-dry lumber to maximum 19-percent moisture content.

2.04 SOURCE QUALITY CONTROL

- A. Lumber shall bear grade-trademark or be accompanied by certificate of compliance of appropriate grading agency.
- B. Plywood shall bear APA grade-trademark.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive rough carpentry Work and verify following:
 1. Completion of installation of building components to receive rough carpentry Work.
 2. That surfaces are satisfactory to receive Work.

3. That spacing, direction, and details of supports are correct to accommodate installation of blocking, backing, stripping, furring and nailers.
4. That all anchor bolts and holdown bolts are properly installed.

3.02 INSTALLATION

- A. Cutting: Perform all cutting, boring, and similar Work required.
- B. Selection of lumber pieces:
 1. Carefully select all members. Select individual pieces so that knots and defects will not interfere with placement of bolts, with nailing or making connections.
 2. Cut-out and discard pieces with defects that make the piece unable to serve its intended function. The Architect may reject lumber, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus or mold as well as for improper cutting or fitting.
 3. Shimming: Do not shim sills, joists, short studs, trimmers, headers, lintels and other framing members unless specifically detailed in drawings.
- C. Drill holes in pieces where splitting may occur.
 1. Remove split lumber and replace with new members.
 2. Fasten framing anchors and steel bridging with galvanized special nails furnished with hardware in every nail hole, except where noted to be welded to structural steel supports in which case comply with AWS requirements.
- D. Studs, Joists, Beams, and Posts: Install all members true to line. No wood shingle shims are permitted. Place joists with crown up; maximum 1/4-inch crown permitted.
- E. Nail joints in accordance with applicable requirements of the CBC Table 2304.9.1 unless otherwise shown or specified. Predrill where nails tend to split wood. Nails into preservative-treated lumber shall be hot-dipped galvanized.
- F. Bolt holes to be 1/16-inch oversize. Threads shall not bear on wood. Use standard malleable iron washers against wood. Carriage bolts require washers under the nut only.
- G. Provide blocking, grounds, nailers, stripping, and backing as shown and as required to secure other Work.
- H. Adjoining sheathing panel edges shall bear and be attached to the framing members. Nails shall be placed not less than 3/8-inch from the panel edge.
- I. Plywood flooring shall be field glued with adhesive meeting APA specification AFG-01 applied in accordance with the manufacturer's recommendations. Apply continuous line of glue on joists and in groove of tongue and groove panels.
- J. Protect preservative-treated and fire-treated lumber per APWA Standard M4, "Standard for the Care of Preservative-Treated Wood Products."

- K. Where wood is cut, sawed, planed, bored or marred after preservative or fire-retardant treatment, apply two heavy brush coats of same material used in treatment.
- L. Nail heads shall be driven flush with plywood surface. Overdriven nails (nails which fracture the outer ply layer) shall be replaced one for one.
- M. Screws (Wood or Lag): Screws shall be screwed and not driven into place. Screw holes for the unthreaded portion shall be predrilled to the same diameter and depth of shank. Holes for threaded portion shall be predrilled less than or equal to the diameter of the root of the thread. Provide standard cut washers under head of lag screws.
- N. Sheathing used for diaphragms and shear walls that are part of the seismic-force-resisting system shall be applied directly to framing members. Sheathing is permitted to be fastened over solid limber planking or laminated decking, provided the sheathing panel joints do not align with the planking or decking joints.

3.03 CLEANING AND ADJUSTING EXPOSED TIMBER

- A. Remove damaged or otherwise disfigured portions and replace with new prior to the Owner's acceptance.
- B. Wash finished Work in strict accordance with product manufacturer's directions and ensure that washed surfaces do not differ from clean unwashed surfaces. Any difference will be considered unsatisfactory work.

3.04 FIELD QUALITY CONTROL

- A. The Owner's Testing Agency shall:
 - 1. Inspect erected timber framing as required to establish conformity of work with Drawings.
 - 2. Inspect all timber connectors per CBC Section 1704A.5.3.
 - 3. Inspect high-load diaphragm nailing and support framing per CBC Section 1704A.5.1.
 - 4. Inspect elements of the seismic lateral force resisting system per CBC Section 1705A.11.
 - a. Inspect floor and roof diaphragm nailing for nail size, spacing and penetration at plywood panel edges, and special nailing at collector and drag members.
 - b. Inspect shear wall nailing for nail size, spacing, edge distance and penetration at plywood panel edges, and nailing at holdown posts.
 - c. Inspect all bolted connections of elements that are part of the seismic lateral force resisting system.
 - d. Inspect holdown bolts into wood and concrete.
- B. Machine Nailing: Use of machine nailing is subject to a satisfactory jobsite demonstration for each project and the approval of the Project Inspector and the

Structural Engineer. The approval is subject to continued satisfactory performance. If the nail heads penetrate the outer ply more than would be normal for a hand-held hammer, or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory and machine nailing shall be discontinued.

3.05 CLEAN-UP

- A. Dispose of pressure-treated wood in an authorized disposal area. DO NOT BURN TREATED WOOD. Do not bury wood of any type on the jobsite.

END OF SECTION

SECTION 06 17 00**SHOP-FABRICATED STRUCTURAL WOOD****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes: Provision and installation of all Structural Composite Lumber, as shown and specified per Contract Documents.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry.
 - 2. Section 06 18 00 - Glued-Laminated Construction.

1.02 REFERENCES

- A. The GENERAL CONDITIONS, SPECIAL CONDITIONS, and DIVISION 1 shall apply to work in this Section.
- B. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section when cited by abbreviations noted below (latest editions apply).
 - 1. California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC), with DSA Amendments
 - 2. American Society of Testing Materials (ASTM): Materials and testing standards as identified throughout this Section.
 - 3. National Design Specification for Wood Construction (NDS) published by the American Forest and Paper Association.
 - 4. Reports:
 - a. International Code Council (ICC): ICC Report ESR-2993.

1.03 QUALITY REQUIREMENTS

- A. Qualifications of Manufacturer: Structural Composite Lumber shall be manufactured by Redbuilt, LLC or equal manufacturer substituted per Section 01 63 00. Substitutions are subject to review by the Structural Engineer. Manufacturer to have a minimum of 5 years experience. Fabricating plant shall be approved by an independent ICC certified testing agency.
- B. Inspection: Fabrication of Structural Composite Lumber shall take place under the supervision of an independent inspection agency.

1.04 SUBMITTALS

- A. Shop Drawings: Submit manufacture, and installation details, including size, type, location and fastening of members, for review.
- B. Samples: If specifically requested.
- C. Product Data: Submit manufacturer's specifications, data, and installation instructions for review.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver members tagged, unloaded carefully, store in a vertical position and handle only as recommended by the manufacturer; protect from adverse environmental conditions until members are installed and protected by permanent means.

1.06 WARRANTY

- A. The products delivered will be free from manufacturing errors or defects in workmanship and material.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Structural Composite Lumber:
 - 1. General: SCL joists conforming to ASTM D2559, manufactured by Redbuilt, LLC; types, sizes and accessories as shown.
 - 2. Laminated Veneer Lumber (LVL): "RedLam" conforming to ICC Report ESR-2993. Species shall be Douglas Fir, Southern Pine or Western Hemlock. Provide:
 - a. Grade for 1.4E or better for rim joists and ledgers.
 - b. Grade for 2.0E for beams, headers, joists and all other members.
 - 3. Accessories:
 - a. General: Blocking, backing, etc., as shown.
 - b. Hardware: Hangers, brackets, straps, ties, etc., as shown.
 - 4. Adhesives: ASTM 2259, exterior type.
- B. Fasteners: As shown.

2.02 FABRICATION

- A. General: In accordance with best practices with adequate plant and equipment and under supervision of properly qualified personnel.

- B. Moisture Content: of components at time of gluing shall not be less than 7 percent or more than 16 percent.

PART 3 - EXECUTION

3.01 PREPARATON

- A. Examination: Examine conditions of work in place before beginning work; report defects.
- B. Measurements: Take field measurements; report variance between plan and field dimensions.
- C. Delivery:
 - 1. Handling: Use equipment and methods that avoid damages that may impair strength of SCL members. Sharp instruments and unprotected wire rope, chain slings and the like shall not be permitted.
 - 2. Storage: Store in a vertical position off the ground, covered and protected from the weather.
- D. Site Preparation: Coordinate placement of bearing and support items.

3.02 INSTALLATION

- A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
- B. Erection: Set structural members level and plumb, in correct position. Make provision for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.

3.03 ADJUSTMENT

- A. General: Prior to acceptance, adjust moveable parts to assure smooth operation.

3.04 CLEANING

- A. General: Keep premises free from accumulation of waste and rubbish. At the completion of work remove surplus materials, rubbish, and debris.

END OF SECTION

SECTION 06 18 00

GLUED-LAMINATED CONSTRUCTION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Section Includes: Provisions of glued-laminated wood items as indicated in the Drawings.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry.
 - 2. Section 06 17 00 – Shop-Fabricated Structural Wood

1.02 REFERENCES

- A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specifications standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work in this Section when cited by abbreviations noted below (latest additions apply).
 - 1. California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC).
 - 2. American Institute of Timber Construction Standards.
 - a. AITC 110 - Standard Appearance Grades for Structural Glued Laminated Timber.
 - b. AITC 111 - Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection.
 - c. AITC 113 - Standard for Dimensions of Glued Laminated Structural Members.
 - d. ANSI/AITC 190.1 - Standard for Structural Glued Laminated Timber.
 - e. AITC 117 - Standard Specifications for Structural Glued Laminated Timber of Softwood Species
 - f. AITC 119 - Standard Specifications for Structural Glued Laminated Timber of Hardwood Species
 - g. AITC 109 - Standard for Preservative Treatment of Structural Glued Laminated Timber.
 - h. AITC 404 – Standard for Radially Reinforcing Curved Glued Laminated Timber Members to Resist Radial Tension

3. American Society of Testing and Materials (ASTM).
4. American Wood Preservers Association.
 - a. AWP Standard T1 – “Processing and Treatment Standard”
 - b. AWP Standard U1 – “Use Category System: Use Specification for Treated Wood”

1.03 QUALITY ASSURANCE

- A. Source Quality Control: Manufacturing and quality assurance procedures shall be in accordance with ANSI/AITC A190.1. All prefabricated structural wood members shall be visually and continuously inspected by a qualified special inspector during fabrication. In conformance with CBC Section 1704A.6.2.1, the special inspector shall verify and identify members by mark and report pertinent data as follows:
 1. Species, grade and slope of grain of lumber meets specification.
 2. Glue is of quality specified.
 3. Glue bond is over entire surface, and specified pressure and temperature has been adhered to.
 4. Moisture content meets specifications.
 5. The special inspector’s verified report shall show, of his own personal knowledge, the work covered by the report has been performed and materials used and installed in every product in accordance with, and in conformity to, the duly approved plans, shop drawings, and specifications.
 6. Special inspection of fabrication is not required for noncustom members of 5-1/8 inch maximum width and 18 inch maximum depth and with a maximum clear span of 32 feet. Members shall be manufactured and marked in accordance with ANSI/AITC A190.1.

1.04 SUBMITTALS

- A. Submit Shop drawings showing complete layout, fabrication, and erection drawings. Drawings shall show all members, including shop cuts and holes, dimensions, laminations, scarfing, adhesive type, moisture content, lumber grade and finish.
- B. Submit AITC or equal Certificate of Conformance indicating that members are in conformance with product standard ANSI/AITC A190.1.
- C. Sample of Preservative – Treated glulam timber to architect for color and appearance.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Do not deliver members to site until adequate preparation for storage is made. Do not erect members until preparation to receive are completed including installation of miscellaneous metal and connecting hardware.

- B. Store member on support not less than twelve (12) inches above ground or one and one-half (1-1/2) inches above concrete slab on grade.

1.06 JOB CONDITIONS

- A. Protection: Wrap individual members for protection during shipment, storage and erection, using Sisalkraft paper without adhesive in accordance with AITC 111. Protect members after erection until acceptance of Work. All field-trimmed ends of surfaces must receive a coat of penetrating-type sealer prior to erection.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Lumber: Lumber used shall be uniformly manufactured and shall be Douglas Fir (Laminating Grades), Grade Combination as noted in the Structural Drawings, graded in accordance with the Standard Grading and Dressing Rules No. 17 of the West Coast Lumber Inspection Bureau with the following additional requirements: Each piece shall be grade marked or certified prior to selection for laminating. When lumber to be used for lamination is resawn, the new size shall meet the grade requirements.
- B. Glues: Use exterior type adhesive conforming to ASTM D2559, resin adhesive of phenol, or melamine base applied in accordance with manufacturer's recommendations. Approved adhesives shall be those which have been acceptably certified as performing satisfactorily for mixing, spreading, storage life, pot life, working life and assembly life recommendations.
- C. Laminating Combinations for Douglas Fir shall meet 24F-V4 for simple beams and 24F-V8 for cantilevered beams (tension lams top and bottom).
- D. Laminating Combinations for Alaskan Yellow Cedar shall meet 20F-V12. Allowable stresses shall be:

Bending $F_b = 2000$ PSI
Compression Perp. to Grain $F_c = 560$ PSI
Horizontal Shear $F_v = 190$ PSI
Modules of Elasticity $E = 1,500,000$ PSI
- E. Preservative Treatment
 - 1. Water-borne preservative treatment conforming to AITC 109.
 - 2. Provide treatment which is either neutral in color or leaves a light brown tint.

2.02 FABRICATION

- A. Fabrication shall be in accordance with the best shop practices, with adequate plant and equipment, and under the supervision of properly qualified personnel, and shall comply with the Standards established by the American Institute of Timber Construction.

- B. The fabricator shall provide adequate facilities and equipment so that laminations are prepared, selected, spread, laid-up, clamped and set within the adhesive manufacturer's specified time limit.

- C. The fabricator shall provide extra length of at least six (6) inches at each end for field trim of all members, or fabricator shall verify field dimensions prior to fabrication of members to insure proper fit. All holes for connections shall be field drilled for proper fit, unless otherwise shown.
- D. At the time of gluing, the lumber shall be conditioned to a moisture content conforming to AITC/ANSI 190.1, Section 4.3.9.
- E. Surfaces of laminations to be glued shall be clean, and shall be free from oil, dust, and other foreign matter which will be detrimental to satisfactory gluing.
- F. Laminations shall be machine finished, but not sanded, to a smooth surface and to a uniform thickness, with a maximum allowable variation of 1/64". Warp, twist or other characteristics which will prevent intimate contact between adjacent glued faces, or will interfere with uniform bending to attain required curvature when under clamping pressure, shall not be permitted.
- G. Glue shall be applied to both sides of each lamination, except for the outer laminations. Mechanical spreaders shall be used, except at scarfs.
- H. The clamping time and curing processes required for the setting of adhesives manufacturer's recommendations. Gluing pressure shall be uniform and shall be at least one hundred (100) lbs. per sq. inch and the minimum pressure shall assure close contact of the wood surfaces and provide a uniformly thin glue line.
- I. All end joints shall comply with AITC/ANSI 190.1.
- J. Appearance Grade: Appearance of members shall be Industrial grade if concealed by finishes, Architectural grade if exposed.

2.03 PRESERVATIVE TREATMENT

- A. All exterior exposed glulam timbers shall be preservative treated.
- B. Douglas Fir glulams shall be treated prior to gluing.
- C. Retention and penetration requirements shall be those shown in AITC 109.
- D. Inspect treated members prior to gluing per AWWA M2, "Standard for Inspection of Wood Products Treated with Preservatives." A quality mark shall be furnished by the treater to the laminator identifying the type of treatment used and that treatment conforms to the requirements of CBC Section 2303.1.8.1.

PART 3 - EXECUTION

3.01 ERECTION

- A. General: Erection shall be in accordance with the best practices, with adequate personnel and equipment and under experienced, qualified supervision. Unless otherwise specified, erection shall conform with standards established by the American Institute of Timber Construction.

- B. Methods of Erection: Prior to starting work the Contractor shall submit to the Architect a description of the methods, sequence of erection and type of equipment he proposes to use for erecting the timber work. This submission and/or review shall not relieve the Contractor of his responsibility for providing the proper methods, equipment, workmanship or safety precautions necessary to satisfactorily complete the work.
- C. Framing and Bracing:
 - 1. All glued-laminated timber work shall be erected true and plumb, temporary bracing shall be used wherever necessary and shall be adequate for all vertical and lateral loads to which the structure may be subjected, including wind and erection equipment and operation of same. Leave temporary bracing in place as long as may be required for safety, and until final framing construction is completed.
 - 2. Wherever piles of materials, erection equipment or other loads are carried by the timber during its erection and until it is braced by final construction, proper provision shall be made to take care of the stresses resulting from such construction loads.
 - 3. No final connections shall be made until the structure has been properly aligned.
 - 4. Notify the Architect at least 48 hours (2 working days) in advance of all erection.
- D. Temporary Construction Platforms: All temporary flooring, planking and scaffolding necessary in connection with the erection of the timber framing or the support of erection machinery shall be provided as part of the erection work. The temporary floors and scaffolding shall conform to the requirements of municipal and/or state laws and governing safety regulations.
- E. Fabrication Errors: The cutting or drilling of timber members in the field for the correction of fabrication errors will not be permitted without prior written approval from the Structural Engineer.
- F. Protect treated wood from mechanical injury when handling. For handling damage, cuts, daps or drilling done in the field, the cuts and holes shall be field treated per AWPA Standard M4.

3.02 DEFECTIVE WORK

- A. Any errors in fabrication or erection shall be cause for rejection of the member or members. Any necessary corrections to make the work proper shall be at the contractor's expense.

3.03 FIELD QUALITY CONTROL

- A. The Owner's Testing Agency shall:
 - 1. Inspect erected glulam framing as required to establish conformity of Work with Drawings.
 - 2. Inspect all bolted connections.

- B. Architect shall inspect exposed glulam timbers for appearance quality and be the final arbiter on acceptability.

END OF SECTION

SECTION 06 20 00**FINISH CARPENTRY****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Interior solid wood, SWD-1 and SWD-2.
 - 2. Interior wood baseboards, WB-1 and WB-2.
 - 3. Sandblasting of existing exposed wood beams, ceiling, decking, and columns followed by application of clear sealer, as indicated on the Drawings.
 - 4. Alternate #1: Provide new South Deck, including fire retardant-treated 4x4 lpe wood, as specified herein, over galvanized painted steel structure and railings, as specified in Section 05 50 00.
 - 5. Alternate #3: Provide additional footage at new South Deck, including fire retardant-treated 4x4 lpe wood, as specified herein, over galvanized painted steel structure and railings, as specified in Section 05 50 00.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Division 01 - General Requirements: For alternates.
 - 2. Section 05 50 00 - Metal Fabrications: Provision of steel deck structure and railings.
 - 3. Section 06 41 10 - Custom Casework: Provision of custom casework.
 - 4. Section 09 64 00 - Wood Flooring: Provision of wood flooring.
 - 5. Section 09 90 00 - Painting and Coating: For field finish painting.

1.02 REFERENCES

- A. ANSI - American National Standards Institute
 - 1. A208.2 - Medium Density Fiberboard for Interior Use.
- B. APA - The Engineered Wood Association
- C. ASTM - American Society for Testing and Materials
 - 1. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. D3498 - Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- D. CALGreen - California Green Building Standards, 2022 Edition
- E. CFR - Code of Federal Regulations
 - 1. 40 CFR 59 - National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.
- F. EPA - Environmental Protection Agency
 - 1. Method 24 - Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings.
- G. WI - Woodwork Institute

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements
 - 1. Composite wood used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Articles 5.504.4.5 and 5.504.4.5.3.
 - 2. Adhesives used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Article 5.504.4.1.

1.04 SUBMITTALS

- A. Product Data: Submit for all items.
- B. Shop Drawings
 - 1. Indicate dimensioned plans, sections, elevations, large scale details, location of each item, materials and wood species, component profiles, fastenings, jointing details, finishes, accessories, hardware location and schedule of finishes.
 - 2. Follow WI standards for shop drawings.
- C. Samples: Submit samples of wood items finished as specified.
 - 1. At least 1 sample of finished solid stock showing complete range of variations in grain, color, and other features, minimum 6 inches by 18 inches.
 - 2. Samples shall be resubmitted for acceptable stain and finish until approved by the Architect.

1.05 QUALITY ASSURANCE

- A. Mockups
 - 1. General
 - a. Mockups which are partially constructed or finished incorrectly will be rejected.
 - b. Remove rejected mockups immediately from the Site.
 - c. Place accepted mockups in a location where mockups can be referenced.
 - d. Accepted mockups shall become the Project standard for tolerances and appearance.
 - e. Coordinate with related trades to construct single integrated mockup as appropriate.
 - 2. Sandblasting of Existing Exposed Wood: Sandblast at low pressure to remove stains and existing finishes; intention is to return existing wood to original and lighter appearance; review sandblasting results for acceptance by the Architect; follow with clear coat finish.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site: Do not deliver interior finish carpentry until environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.
- B. Storage and Protection: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack plywood. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Solid Wood: Lumber shall bear the grade and trademark of the association under whose rules it is produced and a mark of mill identification. Lumber shall be of sound stock, thoroughly seasoned, kiln-dried to a moisture content not exceeding 19 percent, and surfaced 4 sides, except as specifically designated for items hereinafter.
 - 1. Exterior
 - a. Alternate #1 and Alternate #3: Fire retardant-treated Ipe.
 - 2. Interior
 - a. SWD-1: Poplar, paint grade, intended for opaque field-applied finish.
 - b. SWD-2: Douglas Fir, Clear Heart Vertical Grain, intended for transparent field-applied finish.
- B. Medium Density Fiberboard (MDF): ANSI A208.2, 3/4-inch thick, Grade 130, made with binder containing no urea formaldehyde.
- C. Fasteners
 - 1. Provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A153, length of fastener embedded into wood substrate to equal 1-1/2 times thickness of items fastened.
 - 2. Countersink nails and fill surface where nailing is unavoidable. Sand smooth and flush for clear finish.
- D. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
 - 1. Use wood glue that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Multipurpose Construction Adhesive: Formulation complying with ASTM D3498 that is recommended for indicated use by adhesive manufacturer.
 - 1. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Putty: Linseed oil type, tinted to match surface finish color.
- G. Fire-Retardant Wood Sealer, Alternate #1 and Alternate #3: Application-ready, water-based fire retardant for treatment of raw wood; mix of proprietary ingredients forms a slight tumescent foam layer and carbon char when the treated wood is exposed to fire; once the carbon char is formed, there will be minimal flame propagation, smoke evolution, or afterglow.
 - 1. Product: As manufactured by Flame Seal Products, Inc., "FSP Fire Retardant Wood Seal", or approved equal.

2.02 FABRICATION

- A. Preparation
 - 1. Verify measurements at job site.
 - 2. Verify details and dimensions of fixtures integral with finish carpentry for proper fit and accurate alignment.
- B. General Fabrication Requirements
 - 1. Factory-fabricate and assemble work in complete units insofar as dimensions permit shipment and installation.

2. Kerf backs of solid members more than 5 inches wide or more than 1 inch nominal thickness.
 3. Conceal nailing where possible and set nail heads for putty in exposed portions.
 4. Perform corrective measures necessitated by non-conformance with WI standards. The Architect's opinion shall govern discrepancies.
 5. Preprime wood and field prime end cuts.
- C. Exterior Solid Wood Fabrications
1. Alternate #1 and Alternate #3: Fire retardant-treated 4x4 lpe wood deck over galvanized painted steel structure and railings, as indicated on the Drawings.
- D. Interior Solid Wood Fabrications
1. Trim and Casework
 - a. SWD-1: Poplar, paint grade, intended for opaque field-applied finish.
 - b. SWD-2: Douglas Fir, Clear Heart Vertical Grain, intended for transparent clear field-applied finish.
 2. Baseboards
 - a. WB-1: 3-1/2 inches, Poplar, paint grade, intended for opaque field-applied finish to match adjacent wall.
 - b. WB-2: 3-1/2 inches, Douglas Fir, Clear Heart Vertical Grain, intended for transparent clear field-applied finish.

2.03 FINISHES

- A. Shop Finishing: Provide items specified in this Section to be fabricated in accordance with WI standards, shop finished in accordance with the following requirements
1. Back Priming: Back prime all concealed wood surfaces.
- B. Preparation For Site Finishing
1. Touch-Up: Touch-up items specified to be shop finished in accordance with requirements of WI.
 2. Items Other Than Those Specified to Be Shop Finished
 - a. Set exposed fasteners. Apply putty in exposed fastener indentations. Sand work smooth and prime.
 - b. Finish paint in accordance with requirements of Section 09 90 00.
 - c. Finish MDF smooth with no visible wart or paint wicking at fasteners.
- C. Transparent and Opaque Finishes: As specified in Section 09 90 00.
- D. lpe Wood Treatment, Alternate #1 and Alternate #3: Site applied, as specified in Section 09 90 00.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General
1. Set work square, level, plumb with edges scribed, accurate, and secure in place with fastenings, clips, braces, brackets, anchors, shims, and blocks.
 2. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

3. Conceal nailing and screwing where possible and set nail heads for putty in exposed portion and conceal screws as indicated.
 4. Miter inside and outside corners of running trim; bevel end joints together.
- B. Wood Surfaces
1. Thoroughly hand sand. Take care that cross sanding is removed by final sanding in direction of grain; ease "knife-edge" corners by sanding.
 2. Ensure free from dust, glue, stains, and other foreign matter and in proper condition to receive finish.
 3. Where indicated, sandblast existing exposed wood at low pressure to remove stains and existing finishes; intention is to return existing wood to original and lighter appearance; provide mockup for Architect's review and acceptance of sandblasting results; follow with clear coat finish.
- C. Fire-Retardant Wood Sealer, Alternate #1 and Alternate #3: Apply in accordance with manufacturer's written instructions.

3.02 ADJUSTING

- A. Repair damaged or defective finish carpentry where possible to eliminate functional or visual defects. Where not possible to repair, replace finish carpentry. Adjust joinery for uniform appearance.

END OF SECTION

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SECTION 06 41 10**CUSTOM CASEWORK****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Solid wood at casework, SWD-1, as indicated.
 - 2. Solid wood at casework, SWD-2, as indicated.
 - 3. Veneer plywood at casework, WDV-1, as indicated.
 - 4. Veneer plywood at casework, WDV-2, as indicated.
 - 5. Metal shelving custom wood canopies and end panels, SWD-1 and WDV-1, as indicated.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 06 20 00 - Finish Carpentry: Provision of finish carpentry.
 - 2. Section 09 72 00 - Wall Coverings: Provision of vinyl-coated fabric wall graphics.
 - 3. Section 09 90 00 - Painting and Coating: For finish painting of items not specified to have factory finish.
 - 4. Section 10 56 13 - Metal Storage Shelving: Provision of metal storage shelving.
 - 5. Section 12 36 61.16 - Solid Surfacing Countertops: Provision of solid surfacing countertops.

1.02 REFERENCES

- A. ADA - Americans with Disabilities Act
- B. ALA - American Laminators Association
- C. ANSI - American National Standards Institute
 - 1. A135.4 - Basic Hardboard.
 - 2. A208.2 - The American National Standard Medium Density Fiberboard for Interior Use.
- D. APA - The Engineered Wood Association
- E. CALGreen - California Green Building Standards, 2022 Edition
- F. CPSC - Consumer Product Safety Commission
 - 1. 16 CFR Part 1601.61 - Reasonable and Representative Testing to Assure Compliance with the Standard for the Clothing Textiles.
- G. DOC - U. S. Department of Commerce
 - 1. Commercial Standard 191 - Flammability of Clothing Textiles.
- H. State of California, Department of Consumer Affairs
 - 1. Technical Bulletin 117 - Requirements, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Materials Used in Upholstered Furniture.
 - 2. Technical Bulletin 133 - Flammability Test Procedure for Seating Furniture for Use in Public Occupancies.
- I. WI - Woodwork Institute

1.03 DEFINITIONS

- A. Exposed Portions - All Grades: Surfaces visible when doors and drawers are closed; underside of bottoms of cabinets over 4 feet above finished floor; cabinet tops under 6 feet above finished floor or if over 6 feet and visible from upper building level or floor; visible front edges of web frames, ends, divisions, tops, shelves, and hanging stiles; visible sloping tops of cabinets; visible portions of bottoms, tops, and ends in front of sliding doors.
 - 1. Additional Exposed Portions - Premium Grade Only
 - a. Visible surfaces in open cabinets or behind glass.
 - b. Interior faces of hinged doors.
- B. Semi-Exposed Portions: Shelves; divisions; interior face of ends, backs, and bottoms; drawer sides, subfronts, backs, and bottoms; underside of bottoms of cabinets between 2-1/2 and 4 feet above finished floor; interior faces of hinged doors, except Premium Grade; visible surfaces in open cabinets or behind glass for Custom Grade and all rooms designated as storage, janitor, closet, or utility.
- C. Concealed Portions: Toe space; sleepers, web frames, stretchers, and solid sub-tops; security panels; underside of bottoms of cabinets less than 2-1/2 feet above finished floor; flat tops of cabinets 6 feet or more above finished floor except if visible from upper building level; 3 non-visible edges of adjustable shelves; underside of countertops, knee spaces, and drawer aprons; faces of cabinet ends of adjoining units that butt together.

1.04 SYSTEM DESCRIPTION

- A. Performance Requirements
 - 1. Composite wood used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Articles 5.504.4.5 and 5.504.4.5.3.
 - 2. Adhesives used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Article 5.504.4.1.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's product literature.
- B. Shop Drawings: Show all items at large scale including methods of fabrication and construction.
- C. Samples
 - 1. Wood Designated to Receive Transparent Finish
 - a. Provide minimum 18 inch square sample for sheet items such as wood panels, with 2 adjacent edges finished, and minimum 18 inch long sample of linear items such as shelves and miscellaneous trim. Provide samples for each different type of wood and finish.
 - b. Resubmit material samples with finishes adjusted as directed, until material and finish are accepted.
 - 2. Upholstery Fabric: Full width by 36-inch long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.
 - 3. Provide 1 sample of each type of hardware specified.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Equipped for and experienced in work equal to standard specified; able to evidence such experience to the Architect's satisfaction.

- B. Fire-Test-Response Characteristics of Upholstered Chairs
 - 1. Fabric: Class 1 according to DOC Commercial Standard 191 and 16 CFR 1610.61, tested according to California Technical Bulletin 117.
 - 2. Padding: Comply with California Technical Bulletin 117.
 - 3. Full-Scale Fire Test: Comply with California Technical Bulletin 133.

1.07 SEQUENCING AND SCHEDULING

- A. Provide information as required for timely and proper placement of backing.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Solid Wood
 - 1. SWD-1: Poplar, paint grade, intended for opaque field-applied finish.
 - 2. SWD-2: Douglas Fir, Clear Heart Vertical Grain, intended for transparent field-applied finish.
- B. Veneer Plywood: APA, Grade AA, 3/4-inch thick, unless otherwise indicated.
 - 1. WDV-1: Poplar, paint grade, intended for opaque field-applied finish.
 - 2. WDV-2: Douglas Fir, Clear Heart Vertical Grain, intended for transparent clear field-applied finish.
- C. Plywood: APA, Grade AA, non-veneered, 3/4-inch thick, unless otherwise indicated.
- D. Hardboard: ANSI A135.4, tempered, smooth surface both faces.
- E. Medium Density Fiberboard: ANSI A208.2, thickness as indicated, paint grade, with low VOC/formaldehyde-free, as manufactured by SierraPine, "Medite II, Medex, or Medite FR2", or approved equal.
- F. Melamine Laminate: Low pressure decorative, ALA approved, color as selected by the Architect.
- G. Scrim at CPU Casework, FAB-1: 100 percent vinyl-coated polyester; weight 16 ounces per square yard; provide at perforated computer cabinet doors.
 - 1. Color: Black.
 - 2. Product: As manufactured by Designtex, or approved equal.
- H. Nails and Screws: Select material, type, size, and finish required for each use.
- I. Anchors
 - 1. Select material, type, size, and finish required for each substrate for secure anchorage.
 - 2. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.
 - 3. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.
- J. Cabinet Hardware
 - 1. General: As scheduled; provide locks at cabinet doors and drawers.
 - 2. Pulls: ADA-compliant, aluminum, modern metal edge, designed for people with reduced mobility, 5-1/32 inches, stainless steel finish, as manufactured by Richelieu, "Modern Aluminum Edge Pull, 9595", or approved equal.

3. Mechanical Opening Support System at Children's Room: Handle-less fronts open at a single touch; to close, simply press shut; combine with unsprung clip-top hinge specified below.
 - a. Product: As manufactured by Blum, "TIP-ON", or approved equal.
4. Slides: Soft-close, as manufactured by Blum, "Movento", or approved equal.
5. Hinges: Clip-top, as manufactured by Blum, "Blumotion", or approved equal.
6. Locks: Casework manufacturer's standard, unless otherwise indicated and approved by the Architect; provide at all cabinets and drawers where indicated on the Drawings.
7. Grommets: Stainless steel, as manufactured by Doug Mockett & Company, Inc., or approved equal.

2.02 FABRICATION

- A. Preparation
 1. Verify dimensions at job site.
 2. Verify details and dimensions of equipment and fixtures integral with casework and other items for proper fit and accurate alignment.
 3. Coordinate details with other work supporting, adjoining, or fastening to casework and other items.
- B. General
 1. Construction Style: WI Style W (Frameless).
 2. Construction Type: WI Premium, multiple self-supporting units rigidly joined together. Factory-fabricate and assemble work in complete units insofar as dimensions permit shipment and installation.
 3. Door and Drawer Front Style: WI Flush, typical, unless otherwise noted.
 4. Door and Drawer Edge Type: WI (Solid Banding).
 5. Perform corrective measures necessitated by non-conformance with WI standards. The Architect's opinion shall govern discrepancies.
- C. Wood Cabinets
 1. Fabricate in accordance with WI, Premium Grade.
 2. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.
 3. WI Construction Style: As indicated on the Drawings.
 4. WI Door and Drawer Front Style: As indicated on the Drawings.
 5. Wood Species and Cut for Exposed Surfaces: Comply with WI Premium Grade.
 6. Grain Matching: Balanced, book matched, and sequenced on all exposed edges.
 7. Semi-exposed Surfaces: Melamine laminate, as indicated on the Drawings.
 8. Finish Quality Standard: Comply with WI Section 15, unless otherwise indicated, custom grade. Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
- D. Hardware
 1. Make provisions in accordance with approved hardware manufacturer's templates.
 2. Fit hardware to casework and attach for smooth, trouble free, nonbinding operation using hardware manufacturer's approved fasteners.

2.03 FINISHING

- A. Backprime surfaces to be set against concrete or plaster.
- B. Field Painting: As specified in Section 09 90 00.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces scheduled to receive casework for conditions that would adversely affect installation.
- B. Do not install work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install wood casework in accordance with WI Premium grade.
- B. Set work square, level, plumb with edges scribed accurately and secure in place with fastenings, clips, braces, brackets, anchors, shims, and blocks.
- C. Conceal fasteners where possible and set nail heads for putty in exposed portions.

3.03 ADJUSTING

- A. Adjust hardware for smooth operation.
- B. Remove damaged or otherwise disfigured portions and replace with new prior to Substantial Completion.

END OF SECTION

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SECTION 06 64 00**PLASTIC PANELING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Plastic wall panel covering, FRP-1.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 09 29 00 - Gypsum Board: Provision of gypsum board.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. CBC - California Building Code, 2022 Edition

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data describing products.
- B. Samples: Submit 1 sample of each type, pattern and color required.
- C. Quality Control Submittals
 - 1. Certificates
 - a. Before installation of plastic paneling, submit certification attesting that the installation supervisor has the required experience.
 - b. Submit a list of previous jobs giving name, location, dollar value and date, setting forth his experience.
 - 2. Manufacturer's Instructions
 - a. Before installation, submit plastic paneling manufacturer's printed instructions for installation.
 - b. Provide complete procedures for an expert installation, including preparation of substrate and application of adhesives and plastic panels.
- D. Contract Closeout Submittals: Submit plastic paneling manufacturer's printed instructions for cleaning and maintenance.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Material shall conform to the following CBC requirements.
 - 1. Flame Spread (ASTM E84): 25 or less.
 - 2. Smoke Developed (ASTM E84): 450 or less.

1.05 PROJECT CONDITIONS

- A. Environmental Requirements
 - 1. Minimum temperature of area to receive plastic paneling, before, during and after installation and requirements for conditioning adhesive and plastic paneling shall comply with plastic paneling manufacturer's printed instructions.
 - 2. However, in no case shall area temperature be less than 50 degrees Fahrenheit 72 hours before, during and 48 hours after installation.

1.06 MAINTENANCE

- A. Extra Materials
 - 1. Provide one 48-inch wide panel.
 - 2. Extra stock shall be of same manufacture, type, pattern, color and lot number as installed plastic paneling.
 - 3. Provide sheet packed for storage and marked with content, pattern and color.
 - 4. Leave extra stock at site in orderly manner as directed.

PART 2 - PRODUCTS**2.01 MANUFACTURER**

- A. Acceptable Manufacturers: Marlite; Koroseal Wall Coverings West; Institutional Products Corp., or approved equal.

2.02 PLASTIC PANELING

- A. Plastic, FRP: Smooth, semi-rigid high impact acrylic/polyvinyl chloride sheet, 0.060-inch thick, 48 inches wide sheets, with the following properties.
 - 1. Texture: "Smooth" finish.
 - 2. Color: White.
- B. Adhesive: Mildew-resistant and nonstaining to wearing surface; as supplied or recommended by reviewed plastic paneling manufacturer.
- C. Caulking: Silicone caulking with color to match plastic paneling as manufactured by DAP, or approved equal.
- D. Accessories: Provide PVC trim to match panels.
 - 1. Joint Cover Strips: Manufacturer's standard.
 - 2. Inside Corners: Manufacturer's standard.
 - 3. Exposed Edges: Manufacturer's standard surface mounted edge cap.
 - 4. Outside Corners: Manufacturer's standard thermoformed corner guards typical at all outside corners.
 - 5. Division Bar: Manufacturer's standard.
 - 6. J-Molding: Manufacturer's standard.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Complete all other trade work that penetrates substrate before beginning plastic paneling installation.
- B. Inspect rooms and areas to be covered. Test walls for moisture content with an electric moisture meter and take corrective measures if reading is more than 5 percent.

- C. Beginning of application means acceptance of existing conditions.

3.02 PREPARATION

- A. Remove dirt, grease, crayon, ink or other similar markings to prevent color staining or bleeding through the plastic paneling.
- B. Fill cracks, crevices and holes with compound recommended by the plastic paneling manufacturer. Sand rough spots smooth. Surfaces to be covered shall be thoroughly dry.
- C. Remove and seal surfaces to be covered in accordance with plastic paneling manufacturer's printed instructions to permit ultimate removal of plastic paneling without damaging wall surface.

3.03 APPLICATION

- A. Apply adhesive and plastic paneling in strict accordance with the manufacturer's printed instructions.
- B. Apply plastic paneling to assure that:
 - 1. Covering is applied without horizontal joints; internal and external angles are continuous.
 - 2. Vertical joints are lapped and double cut or factory trimmed and butted.
 - 3. Edges extend not less than 1/2-inch behind applied base and trim unless otherwise indicated.
 - 4. Seams and corners are securely applied so no moisture or water vapor can get behind plastic paneling.
 - 5. Panel edges, corners, butt joints, etc. are covered so that no panel edges are exposed.
 - 6. Plastic paneling extends behind edges of switch plates and other surface mounted equipment.
 - 7. Colors are uniform.
 - 8. Finished surfaces are free of air pockets, wrinkles, tears and other defects.
- C. Plastic Paneling: Apply with contact cement for Class A fire rating with vertical joints of beveled lap joint with 1/16-inch gap over battens.

3.04 CLEANING

- A. Remove excess adhesive from each seam and wipe plastic paneling clean, removing adhesive, dirt and soiling. There shall be no residual stain after cleaning.

END OF SECTION

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SECTION 07 13 00**SHEET WATERPROOFING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Below-grade sheet waterproofing where indicated.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
 - 2. D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
 - 3. D570 - Standard Test Method for Water Absorption of Plastics.
 - 4. D3767 - Standard Practice for Rubber-Measurement of Dimensions.
 - 5. D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
 - 6. D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 - 7. D5957 -Standard Guide for Flood Testing Horizontal Waterproofing Installations.
 - 8. E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, including manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties.
- B. Shop Drawings: Submit shop Drawings showing locations and extent of waterproofing, including details for substrate joints and cracks, sheet flashings, penetrations, tie-ins with adjoining construction, and other termination conditions.

1.04 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.05 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other 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: Submit a written warranty signed by waterproofing manufacturer and installer agreeing to repair or replace waterproofing that does not meet requirements or that does not remain watertight during the specified warranty period.
 - 1. Warranty Period: 5 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sheet Membrane Waterproofing: Self-adhesive, cold-applied composite sheet consisting of a thickness of 0.056-inch of rubberized asphalt and 0.004-inch of cross-laminated, high density polyethylene film; rubberized asphalt membrane is covered with a release sheet, which is removed during installation; no special adhesive or heat shall be required to form laps.
 - 1. Physical Properties
 - a. Color: Dark gray-black.
 - b. Thickness: ASTM D3767, Method A; 0.060-inch nominal.
 - c. Tensile Strength: 325 psi minimum; ASTM D412, Die C, modified.
 - d. Ultimate Elongation: 300 percent minimum; ASTM D412, Die C, modified.
 - e. Crack Cycling: Unaffected at -25 degrees Fahrenheit; ASTM C836.
 - f. Puncture Resistance: 50 lbf minimum; ASTM E154.
 - g. Water Absorption: 0.1 percent weight-gain maximum after 48 hour immersion at 70 degrees Fahrenheit; ASTM D570.
 - 2. Product: As manufactured by GCP Applied Technologies, "BITUTHENE 3000", or approved equal.

2.02 AUXILIARY MATERIALS

- A. Prefabricated Drainage Composite: Promotes positive drainage while serving as a protection course, as manufactured by GCP Applied Technologies, "HYDRODUCT 220" and/or "HYDRODUCT 660", or approved equal.
- B. Waterstop: Hydrophilic type for non-moving concrete construction joints, as manufactured by GCP Applied Technologies, "ADCOR", or approved equal.
- C. Miscellaneous Materials: Surface conditioner, mastic, liquid membrane, tape, and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions under which waterproofing systems will be applied, with installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.
 - 1. Do not proceed with installation until after minimum concrete curing period recommended by waterproofing manufacturer.
 - 2. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
 - 3. Notify the Architect in writing of anticipated problems using waterproofing over substrate.
- B. Conduct preinstallation conference.

3.02 SURFACE PREPARATION

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.
- B. Remove grease, oil, bitumen, form release agents, paints, and other penetrating contaminants from concrete.
- C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- D. Prepare, fill, prime, and treat joints and cracks in substrate. Remove dust and dirt from joints and cracks according to ASTM D4258.
- E. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.03 SELF-ADHERING COMPOSITE SHEET APPLICATION

- A. General: Install self-adhering composite sheet according to waterproofing manufacturer's written instructions.
- B. Apply primer to substrate at required rate and allow to dry. Limit priming to areas that will be covered by waterproofing membrane in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheet membrane 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 degrees Fahrenheit, install manufacturer's standard, low-temperature, rubberized-asphalt composite sheet.
- D. Apply sheet membrane from low point to high point of deck to ensure side laps shed water.
- E. Apply continuous sheet membrane over membrane strips bridging each type of joint to dimensions indicated or required by manufacturer.
- F. Seal exposed edges of membrane terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.
- G. At Protrusions and Drains: Apply membrane to within 1 inch of base of the protrusion. Apply fillet around protrusion and extend over membrane minimum of 2-1/2 inches and up the penetration to just below the finished height of the wearing course.
- H. Install sheet membrane and auxiliary materials to tie in adjacent waterproofing.
- I. Repair tears, voids, and lapped seams in waterproofing not meeting requirements. Slit and flatten fishmouths and blisters. Patch with sheet membrane extending 6 inches beyond repaired areas in all directions. Comply with manufacturer's requirements.

3.04 SHEET FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to waterproofing manufacturer's written instructions.

- B. Extend sheet flashings over deck sheet waterproofing. Flash penetrations and field-formed inside and outside corner accessories with sheet flashing.
- C. Installation to include pre-installation of waterproof membrane at wall to deck intersection, lap out onto deck minimum 6 inches and up flashing 8 inches. Pre-installation to occur due to construction sequence where weather board lap is required with wall flashing and full waterproof membrane installation cannot occur due to pending installations.
- D. Prior to completion of membrane installation, the pre-installed membrane will be inspected, repaired, patched and cleaned. The waterproof membrane manufacturer shall review pre-installed membrane and surrounding substrate and confirm as acceptable ready for completion of membrane installation.
- E. Terminate and seal top of sheet waterproofing per manufacturer's written instructions.

3.05 PROTECTION COURSE INSTALLATION

- A. Install protection course over waterproofing membrane using tape or adhesive according to manufacturer's written instructions and before commencing subsequent construction operations. Minimize exposure of membrane. Protection course to occur below hardscape over waterproof membrane at concrete decks and wood framed decks.

3.06 DRAINAGE PANEL INSTALLATION

- A. Place and secure drainage panels according to manufacturer's written instructions at locations indicated on the Construction Documents. Use adhesives and mechanical fasteners recommended by manufacturer that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed panels during subsequent construction.

3.07 INCLEMENT WEATHER

- A. Concrete substrate shall be manual/machine dry to moisture level acceptable to waterproof manufacturer. Dry extent of area that can be covered prior to next inclement weather. The cost of repeat drying of areas unable to be covered by sheet membrane based on continued inclement weather will be by the Contractor.
- B. Sacrificial Coat: Seal any exposed wood subject to moisture and scheduled to receive sheet waterproof membrane with a 25 mil coat of Sonneborn, "HLM 5000", or approved equal. Contractor shall take care to protect, patch and maintain seal during inclement weather until final waterproof membrane can be installed. Install sheet waterproof membrane specified when construction schedule and weather accommodate. Review substrate with sheet membrane manufacturer for acceptance prior to installation.

3.08 FIELD QUALITY CONTROL

- A. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
 - 2. Flood each area for 24 hours.
 - 3. After flooding testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

- B. The Owner will engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

3.09 PROTECTING AND CLEANING

- A. Protect waterproofing from damage and wear during application and remainder of construction period according to manufacturer's written instructions.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 07 16 16**CRYSTALLINE WATERPROOFING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Cementitious crystalline waterproofing.
 - 1. Surface-applied at existing concrete masonry units (CMU).
 - 2. Part of concrete mix for new cast-in-place concrete and shotcrete.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 03 30 00 - Cast-In-Place Concrete: Provision of cast-in-place concrete.

1.02 REFERENCES

- A. ICRI - International Concrete Repair Institute

1.03 SUBMITTALS

- A. Product Data: Include material descriptions and installation instructions for crystalline waterproofing.

1.04 QUALITY ASSURANCE

- A. Qualifications
 - 1. Applicator: Endorsement by waterproofing materials manufacturer and documented 5 years minimum experience in the application of reviewed waterproofing system. Provide list of installations of similar nature with Project names, locations, and dates.
 - 2. Concrete Batch Plant: Trained and certified by the crystalline-capillary waterproofing company for waterproofing.
- B. Pre-Installation Conference: Schedule and hold a pre-installation conference at the Project site with installer to review the work and coordinate with each other's scope to provide a fully waterproof system.

1.05 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of crystalline waterproofing that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, failure to maintain watertight conditions within specified warranty period.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturer
 - 1. Ad Mix: Xypex Chemical Corporation, "Admix C-Series", or approved equal.

2. Surface-Applied: Xypex Chemical Corporation, "Xypex Concentrate", or approved equal.

2.02 MATERIALS

- A. Crystalline Waterproofing: Consists of a blend of portland cement, fine treated silica sand, and active proprietary chemicals. When mixed with water and applied as a cementitious coating, the active chemicals diffuse into the concrete and cause a catalytic reaction which generates a non-soluble crystalline structure within the pores and capillary tracts of concrete. This crystalline system causes the concrete to become sealed against the penetration of liquids from any direction and protects the concrete from deterioration due to harsh environmental conditions. The system is used for above- or below-grade walls and slabs, including liquid retaining structures and where enhanced chemical resistance is required.
 1. Admixture can be added to concrete at the time of batching.
- B. Accessory Materials: Waterproofing manufacturer's standard products.

2.03 MIXES

- A. General: Mix waterproofing material by volume with clean, potable water. Mix waterproofing material in quantities that can be applied within 20 to 30 minutes from time of mixing. As mixture thickens, stir frequently, but do not add additional water. Do not mix bonding agents or admixtures with crystalline waterproofing materials.
- B. Brush Application Mix: Measure dry powder and place in mixing container. Measure water and mix into the dry powder with a paddle on a slow speed electric drill (250 RPM) or other type mixer which is acceptable to manufacturer. Mixing proportions shall be as follows:

Coverage	Proportions (by Volume)
1.5 lb./sq. yd.	5 powder to 2 water
2.0 lb./sq. yd.	3 powder to 1 water

- C. Spray Application Mix: Mixing shall be same as specified for brush application except that mixture shall be thinner. Use following proportions as a guide only. Adjust proportions to match type of spray equipment and pressures used. Mixing proportions shall be as follows:

Coverage	Proportions (by Volume)
1.5 lb./sq. yd.	5 powder to 3 water

- D. Dry-Pac Mix: Using a trowel, mix 1 part clean water with 6 parts concentrate powder for 10 to 15 seconds. It is acceptable that lumps may be present in mixture. Mix only as much as can be applied in 15 minutes.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Site Visit: Prior to waterproofing installation, arrange visit to project site with waterproofing manufacturer's representative. Representative shall inspect and certify that concrete surfaces are in acceptable condition to receive waterproofing treatment.
- B. Verification of Substrates: Verify that concrete surfaces are sound and clean, and that form release agents and materials used to cure the concrete are fully removed.

- C. Examination for Defects: Examine surfaces to be waterproofed for defects such as honeycombing, rock pockets, faulty construction joints and cracks. Such defects to be repaired in accordance to manufacturer's product data and 3.02 below.

3.02 PREPARATION

- A. Surface Preparation: Smooth surfaces (e.g., where steel forms are used) or surfaces covered with form oil or other contaminants shall be cleaned, water-blasted, lightly sand-blasted, or acid etched as necessary to provide a clean absorbent surface. The surface must also have an open capillary system to provide "tooth and suction" for the crystalline treatment. A minimum of CSP-3 per the ICRI Concrete Surface Profile Chips or other equivalent standard is required. Surfaces to be acid-etched shall be saturated with water before application of the acid. After acid etching, flush concrete thoroughly with clean water. Horizontal surfaces shall have a rough wood float or broom finish. Where a smooth trowel finish is required on horizontal surface, crystalline waterproofing material shall be applied by dry shake method at time of concrete finishing in accordance with manufacturer's product data.
- B. Repair of Defects: Concrete defects shall be repaired in accordance with manufacturer's technical literature including relevant Method Statements (www.xypex.com/technical/statements). Procedures are generally as follows:
1. Cracks and Faulty Construction Joints
 - a. Chip out cracks, faulty construction joints and other defects to a depth of 1.5 inches and a width of one inch. A "V" shaped slot is not acceptable. The slot may be saw cut instead of chipped but ensure that the slot is dovetailed or otherwise shaped such that there will be mechanical interlock of materials placed into the slot at a later stage.
 - b. Clean slot of debris and dust. Soak area with water and remove excess surface water. Apply a slurry coat of concentrate at the rate of 1.5 lb./sq. yd. to the slot.
 - c. While slurry coat is still tacky, fill cavity with Dry-Pac. Compress tightly into cavity using pneumatic packer or block and hammer.
 - 1) This step may be omitted if the area filled with Dry-Pac will be subsequently covered with Xypex coating. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Xypex Concentrate at a coverage rate of 1.5 - 2 lb./sq. yd. over the repaired area to 6 inches on either side of slot.
 2. Rock Pockets, Honeycombing, or other Defective Concrete: All areas of poor concrete consolidation (honeycomb or rock pockets) shall be repaired.
 3. Note: Where there is active water-flow see Method Statements or contact Xypex Technical Services Representative for assistance.
- C. Wetting Concrete: Xypex requires a saturated surface dry (SSD) substrate. Concrete surfaces must be thoroughly saturated with clean water prior to the application so as to aid the proper diffusion of the Xypex chemistry and to ensure the growth of the crystalline formation deep within the pores of the concrete. Remove excess water before the application such that there is no glistening water on the surface. If concrete dries out before application, it must be re-wetted.

3.03 APPLICATION

- A. Admixture: In accordance with manufacturer's written instructions.
- B. Construction Joints: In addition to specified waterstops, apply one coat of Xypex Concentrate slurry at a rate of 2 lb./sq. yd. to joint surfaces between concrete pours.

Moisten surfaces prior to slurry application. Apply slurry and keep moist for 12 hours then allow slurry to set or dry. Where joint surfaces are not accessible prior to pouring new concrete, contact Xypex Technical Services Representative for assistance.

1. Note: Inclusion, type and position of waterstops are at the discretion of the designer. Expanding waterstops may be placed on Xypex after it has dried or before Xypex slurry application. Xypex slurry may only be applied over waterstop if approved by waterstop manufacturer.
- B. Sealing Strips: Where hydrostatic conditions exist, sealing strips shall also be applied at construction joints by filling grooves that are created along the joints. Dimensions of the grooves shall be 1 inch wide and 1.5 inches deep. If grooves are not pre-formed, then chip grooves to those dimensions. Fill the grooves as follows:
1. Apply slurry coat of Xypex Concentrate slurry to slot in accordance with manufacturer's instructions or recommendations.
 2. While slurry coat is still tacky, fill slot with Xypex Concentrate Dry-Pac.
 3. Compact tightly using pneumatic packer or hammer and block.
 4. This step may be omitted if the area filled with Dry-Pac will be subsequently covered with Xypex coating. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Xypex Concentrate at a coverage rate of 1.5 - 2 lb./sq. yd. over sealing strip and extending to 6 inches on either side.
 5. Note: For further information, see Xypex Schematic Drawings for standard construction joint details.
- C. Form Tie Holes: Form tie holes shall be waterproofed in accordance with manufacturer's technical literature including relevant Method Statements (www.xypex.com/technical/statements). Procedures are generally as follows:
1. Prepare the tie hole to create a straight sided void with a profile of at least ICRI CSP-3. For through element ties holes such as those created by taper ties the prepared void is to be at least 5 inches deep. For cone ties the void is to be to the bottom of the cone.
 2. Clean and profile the area to a 12-inch diameter around the tie hole to an ICRI CSP-3 profile.
 3. For through-element tie holes, create a solid plug of material at the bottom of the profiled hole using Xypex Patch'n Plug leaving at least 4 inches of empty tie hole from the top of the plug to the surface of the concrete element.
 4. Apply a coat of Xypex Concentrate slurry at a rate of 1.5 lb./sq. yd. to the inside of the tie hole and to a 12-inch diameter area around the hole.
 5. Fill and compact the tie hole with Xypex Concentrate Dry-Pac.
 6. Note: This step may be omitted if the area filled with Dry-Pac will be subsequently covered with Xypex coating. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Xypex Concentrate at a coverage rate of 1.5 - 2 lb./sq. yd. over the repaired area to a 12-inch diameter area around the filled void.
- D. Surface Application: After repairs, surface preparation, treatment of construction joints, and sealing strip placement have been completed in accordance with manufacturer's product data and as specified herein, apply Xypex treatment to concrete surfaces with semi-stiff bristle brush, push broom (for large horizontal surfaces), or suitable spray equipment. The Xypex coating must be uniformly applied and should be just under 1/16-inch thick.
1. Application rates and locations shall be as indicated in the Drawings and in accordance with manufacturer's product data. When brushing, work slurry well into surface of the concrete, filling surface pores and hairline cracks. When spraying, hold nozzle close enough to ensure that slurry is forced into pores and hairline cracks.

2. First Coat (of one or two coat application): Apply Xypex Concentrate slurry coat to locations indicated on Drawings in accordance with manufacturer's product data.
 3. Second Coat (of two coat application): Where indicated on Drawings or as required by manufacturer's product data, apply Xypex Modified or Xypex Concentrate slurry coat after the first coat of Xypex Concentrate has reached an initial set but while it is still "green" (less than 48 hours). Curing by misting the coating with water should be done between coats. Ensure first coat is in SSD condition before application of the second coat.
 4. Note: Prior to the installation, it is recommended that a test section be completed under anticipated ambient and project conditions to demonstrate acceptable bond
- E. Sandwich (Topping) Application: When treated structural slabs are to receive a concrete or other topping, place the topping while waterproofing material is still "green" (less than 48 hours) but after it has reached an initial set. The preferred time frame is 12 to 24 hours after the installation of Xypex coating. Curing by misting the coating with water should be done between application of coating and installation of concrete overlay. Ensure coating is in SSD condition prior to placement of concrete.

3.04 CURING

- A. General: Begin curing as soon as Xypex coating has hardened sufficiently so as not to be damaged by a fine spray. Cure Xypex treatment with a mist fog spray of clean water three times a day for 2 to 3 days. Wet burlap and some specialty curing blankets are also effective for curing during the prescribed period. In warm climates, more than three sprayings per day may be necessary to prevent excessive drying of coating.
- B. Air Circulation: Do not lay plastic sheeting directly on the waterproofing coating as air contact is required for proper curing. If poor air circulation exists in treated areas, it may be necessary to provide fans or blown air to aid in curing of waterproofing treatment.
- C. Holding Structures: For water holding structures such as swimming pools, reservoirs, water treatment tanks and wet wells, cure Xypex treatment for three days and then allow treatment to set for 12 days before filling. For structures holding hot or corrosive liquids, cure waterproofing treatment for three days and allow to set for 18 days before filling.
- D. Protection: During the curing period, protect treated surfaces from damage by wind, sun, rain, puddling of water and temperatures below 36 degrees Fahrenheit. If plastic sheeting is used for protection, it must be raised off of the waterproofing coating to allow sufficient air circulation.

3.05 INTERFACE WITH OTHER MATERIALS

- A. Backfilling: Do not backfill for 36 hours after application. If backfill takes place within seven days after application, then backfill material shall be moist so as not to draw moisture from waterproof coating.
- B. Paint, Epoxy or Similar Coatings: Do not proceed with surface preparation or application of paint or other coatings until waterproofing treatment has cured and set for a minimum of 21 days. Light abrasive blasting or washing the Xypex surface with a 3 - 5 percent acid solution followed by a rigorous rinse with clean water is recommended before applying the coating. Be sure to flush all acid off the surface. Alternately, removal of the Xypex coating

by high pressure washing or abrasive blasting following full curing is acceptable. Consult epoxy and paint manufacturer for additional coating instructions and restrictions.

- C. Grout, Cement Parge Coat, Plaster or Stucco: It is recommended that any other cementitious system be applied over the Xypex coating after the Xypex has completely set but while it is still "green" (12 to 48 hours). The 12-to-24 hour window is considered ideal. Contact your Xypex Technical Services Representative regarding surface preparation and other procedures for installations of other materials onto Xypex coatings older than 48 hours. Alternately, removal of the Xypex coating by high pressure washing or abrasive blasting following full 21-day curing is acceptable. Use of a polymer additive to help improve bond in the over coating mortar mix should be considered.
- D. Responsibility to Ensure Compatibility: Xypex Chemical Corporation makes no representations or warranties regarding compatibility of Xypex treatment with coatings, plasters, stuccos, tiles, or other surface-applied materials. It shall be the responsibility of the installer of the surface-applied material that is to be applied over the Xypex waterproofing treatment, to take whatever measures are necessary, including testing, to ensure acceptance by or adhesion to the waterproofing treatment.
- E. Note: Prior to the installation, it is recommended that a test section be completed under anticipated ambient and project conditions to demonstrate acceptable bond.

3.06 FIELD QUALITY CONTROL

- A. Observation: Do not conceal installed waterproofing system before it has been observed by Architect/Engineer, waterproofing manufacturer's representative and other designated entities.
- B. Testing for Tanks and Foundation Works
 - 1. Testing: Fill tanks or, for foundation works, shut off dewatering system as soon as practical so that the structure shall be exposed to its normal service conditions. Examine for leaks.
 - 2. Monitoring
 - a. Actively leaking cracks and joints shall be left to self-heal for as long as practical. Depending on job site and ambient conditions, crack healing can be expected to take several days to weeks.
 - b. Any crack or joints that do not heal in the allowable time frame shall be repaired by the General Contractor.
 - c. Moving cracks shall be repaired using polyurethane injection or other appropriate method.
 - 3. Repair: Use Xypex repair procedures to seal any static crack or joint that does not self-heal. See Method Statements (www.xypex.com/technical/statements) or contact Xypex Technical Services Representative for appropriate repair procedures.
 - 4. Note: Lower temperatures will extend the times for crystalline development.

3.07 CLEANING AND PROTECTION

- A. Cleaning: Clean spillage and soiling from adjacent surfaces using appropriate cleaning agents and procedures.

- B. Protection: Take measures to protect completed Xypex coating until the coating is hard enough to not be damaged. In normal conditions protect from pedestrian traffic for 3 days and vehicular traffic for 7 days. If coatings will be exposed to ongoing vehicular traffic or other abrasive environments consult Xypex Technical Services.

END OF SECTION

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SECTION 07 21 01**BUILDING INSULATION****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Thermal and acoustical insulation.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 07 54 19 - Polyvinyl Chloride (PVC) Roofing: Provision of PVC roofing system.
 - 2. Section 09 29 00 - Gypsum Board: Provision of gypsum board.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 2. C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 3. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 4. E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.
- B. CALGreen - California Green Building Standards, 2022 Edition
- C. UL - Underwriters Laboratories Inc.

1.03 DEFINITIONS

- A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values", they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees Fahrenheit between the 2 exposed faces required to cause 1 BTU to flow through 1 square foot per hour at mean temperatures indicated.

1.04 SYSTEM DESCRIPTION

- A. Insulation used on the Project shall comply with CALGreen Code Nonresidential Voluntary Measures Appendix A5, Division A5.5, Section A5.504, Articles A5.504.4.8 and A5.504.4.8.2.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for insulation products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect fiberglass and acoustical materials from moisture during storage and installation.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Thermal Insulation
 - 1. Type 1: Unfaced, friction-fit, flexible batt or blanket of fiberglass, width to fit stud space, formaldehyde-free, 25 percent recycled content, conforming to ASTM C665, Type I, non-combustible when tested in accordance with ASTM E136, having thermal resistance rating as indicated.
 - a. Fire resistive requirements when tested in accordance with ASTM E84:
 - 1) Flame Spread: 25.
 - 2) Smoke Developed: 50.
 - b. Product: As manufactured by Owens Corning, "EcoTouch® PINK® FIBERGLAS™ Insulation with PureFiber® Technology"; Johns Manville; Certaineed Corporation, or approved equal.
 - 2. Type 2: Nonstructural, rigid board insulation consisting of a glass-fiber-infused polyisocyanurate foam core laminated between 1.0 mil smooth, reflective aluminum facers on both sides; meets ASTM C1289, Type I, Class 2.
 - a. Thickness: As indicated.
 - b. Product: As manufactured by The Dow Chemical Company, "THERMAX™ Sheathing", or approved equal.
- B. Acoustical Insulation: Unfaced, 3-1/2 inches thick, friction-fit, flexible batt or blanket of fiberglass, formaldehyde-free, width to fit stud space, thickness as indicated to completely fill stud cavity, and conforming to ASTM C665, Type I, non-combustible when tested in accordance with ASTM E136.
 - 1. Fire resistive requirements when tested in accordance with ASTM E84:
 - a. Flame Spread: 25.
 - b. Smoke Developed: 50.
 - 2. Product: As manufactured by Owens Corning, "EcoTouch® PINK® FIBERGLAS™ Insulation with PureFiber® Technology"; Johns Manville; Certaineed Corporation, or approved equal.
- C. Insulation Support: Galvanized springwire as required.

PART 3 - EXECUTION**3.01 INSTALLATION, GENERAL**

- A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, use mechanical anchorage to provide permanent placement and support of units.
- B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.
- C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness. Avoid crinkling and bending so that final installation is flat and smooth.
- D. Install spindle fasteners at metal deck insulation in accordance with manufacturer's written instructions.

3.02 INSTALLATION OF ACOUSTICAL INSULATION

- A. Install batt insulation as indicated on the Drawings and as directed below.
- B. Install batt insulation above all suspended gypsum board ceilings.
- C. Install batt insulation to fill framing cavities and fasten to framing to prevent slipping at sound-rated construction.
- D. Install insulation batts around perimeter of piping and electrical boxes in sound-rated wall/ceiling cavities.
- E. Pack sound insulation batts around perimeter of bathtubs.
- F. At all exposed conditions in occupiable spaces, provide edge trim at edges of wall installations. Insulation shall not be visible at joints between adjacent panels.

3.03 PROTECTION

- A. General: Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

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SECTION 07 27 10**WEATHER-RESISTANT BARRIERS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Weather-resistant barrier.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 07 40 00 - Roofing and Siding Panels: Provision of metal panels at exterior.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. NFPA - National Fire Protection Association
 - 1. 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer current technical literature for each component.
- B. Samples: Weather-resistant barrier membrane, minimum 8-1/2 inches by 11 inches.
- C. Quality Assurance Submittals
 - 1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
 - 2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
 - 3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather-resistant barrier assembly installation.
- D. Closeout Submittals: Manufacturer's executed weather-resistant barrier warranty form with authorized signatures and endorsements indicating date of Final Completion.

1.04 QUALITY ASSURANCE

- A. Qualifications
 - 1. Installer shall have experience with installation of commercial weather-resistant barrier assemblies under similar conditions.
 - 2. Installation shall be in accordance with weather-resistant barrier manufacturer's installation guidelines and recommendations.
 - 3. Source Limitations: Provide commercial weather-resistant barrier and accessory materials produced by single manufacturer.

- B. Pre-Installation Meeting
 - 1. Hold a pre-installation conference, 2 weeks prior to start of weather-resistant barrier installation. Attendees shall include Contractor, Architect, installer, and weather-resistant barrier manufacturer's designated representative. Include installers of other construction connecting to weather-resistant barrier, such as roofing, siding, waterproofing, joint sealants, windows, door frames, and louvers.
 - 2. Review related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather-resistant barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver weather-resistant barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store weather-resistant barrier materials as recommended by weather-resistant barrier manufacturer.

1.06 SCHEDULING

- A. Review requirements for sequencing of installation of weather-resistant barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.
- B. Schedule installation of weather-resistant barrier materials and exterior cladding within nine months of weather-resistant barrier assembly installation.

1.07 WARRANTY

- A. Special Warranty
 - 1. Special weather-resistant barrier manufacturer's warranty for weather-resistant barrier assembly for a period of 10 years from date of Substantial Completion.
 - 2. Approval by weather-resistant barrier manufacturer for warranty is required prior to assembly installation.
 - 3. Warranty Areas: Areas of installation of weather-resistant barrier.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: GCP Applied Technologies,, "Perm-A-Barrier VPS 30", or approved equal.

2.02 MATERIALS

- A. Weather-Resistant Membrane: Primerless, vapor permeable air- and water-barrier membrane consisting of a proprietary breathable carrier film with a specially designed adhesive; Class A, ASTM E84; meets NFPA 285 as part of various wall assemblies.
- B. Seam Tape: 3 inches wide, as recommended by weather-resistant barrier manufacturer.
- C. Flashing
 - 1. Flexible Flashing at Openings in Walls: As specified in Section 07 65 00.
 - 2. Metal Flashing: As specified in Section 07 62 00.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify substrate and surface conditions are in accordance with weather-resistant barrier manufacturer recommended tolerances prior to installation of weather-resistant barrier and accessories.

3.02 INSTALLATION

- A. Install weather-resistant barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.
- B. Start weather-resistant barrier installation at a building corner, leaving 6-12 inches of weather-resistant barrier extended beyond corner to overlap.
- C. Install weather-resistant barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Weather-resistant barrier laps shall be separate for each layer. Maintain weather-resistant barrier plumb and level.
- D. Sill Plate Interface: Extend lower edge of weather-resistant barrier over sill plate interface 3-6 inches. Secure to foundation with elastomeric sealant as recommended by weather-resistant barrier manufacturer.
- E. Window and Door Openings: See Details.
- F. Overlap Weather-Resistant Barrier
 - 1. Exterior corners: minimum 12 inches.
 - 2. Seams: minimum 6 inches.
 - 3. Door and Window Openings: Minimum 24 inches.
- G. Weather-Resistant Barrier Attachment: Secure weather-resistant barrier to exterior sheathing.

3.03 SEAMING

- A. Seal seams of weather-resistant barrier with seam tape at all vertical and horizontal overlapping seams.
- B. Seal any tears or cuts as recommended by weather-resistant barrier manufacturer.

3.04 OPENING PREPARATION

- A. Flush cut weather-resistant barrier at edge of sheathing around full perimeter of opening.
- B. Flashing of Openings in Walls: As specified in Section 07 65 00.

3.05 FIELD QUALITY CONTROL

- A. Notify manufacturer's designated representative to obtain required periodic observations of weather-resistant barrier assembly installation.

3.06 PROTECTION

- A. Protect installed weather-resistant barrier from damage.

END OF SECTION

SECTION 07 40 00**ROOFING AND SIDING PANELS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Field-assembled metal roofing and siding panels.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 05 50 00 - Metal Fabrications: Provision of brake metal panels pre-finished to match roofing and siding panels.
 - 2. Section 07 27 10 - Weather-Resistant Barriers: Provision of weather-resistant barriers.
 - 3. Section 07 62 00 - Sheet Metal Flashing and Trim: For color finish of aluminum.
 - 4. Section 07 92 00 - Joint Sealants: Provision of sealants.
 - 5. Section 09 29 00 - Gypsum Board: Provision of gypsum sheathing.

1.02 REFERENCES

- A. AAMA - American Architectural Manufacturers Association
 - 1. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. AISI - American Institute of Steel Construction
 - 1. Manual of Steel Construction "Code of Standard Practice".
- C. ASTM - American Society for Testing and Materials
 - 1. A606 - Standard Specification for Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High-Strength, Low-Alloy, with Improved Corrosion Resistance.
 - 2. A792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 3. E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - 4. E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - 5. E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- D. SSPC - The Society for Protective Coatings
 - 1. Paint 12 - Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).

1.03 SYSTEM DESCRIPTION

- A. Design Requirements
 - 1. Systems not using a construction sealant at panel joints (Dry Systems) shall be designed to drain any water leakage occurring at the joints.
 - 2. Wind Load: Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 20 psf and 30 psf on parapet

and corner panels. Wind load testing shall be conducted in accordance with ASTM E330 to obtain the following results.

- a. Normal to the plane of the wall between supports, deflection of the secured perimeter framing members shall not exceed $L/175$ or 3/4-inch, whichever is less.
- b. Normal to the plane of the wall, the maximum panel deflection shall not exceed $L/60$ of the full span.
- c. Maximum anchor deflection shall not exceed 1/16-inch.
- d. At 1-1/2 times design pressure, permanent deflections of framing members shall not exceed $L/100$ of span length and components shall not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16-inch.

B. Performance Requirements

1. Provide certified test results by a recognized testing laboratory or agency in accordance with specified test methods for each system.
2. Air Infiltration: Provide wall panel systems with an air infiltration rate of not more than 0.06 cfm/sf of fixed wall area when tested in accordance with ASTM E283 at a static air pressure differential of 1.57 psf.
3. Water Penetration: Provide panel systems with no water penetration as defined in the test method when tested in accordance with ASTM E331 at an inward static air pressure differential of not less than 6.24 psf.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data including manufacturer's product specifications, standard details, certified product test results, installation instructions and general recommendations, as applicable to materials and finishes for each component and for total panel system.
- B. Shop Drawings: Submit shop drawings showing layouts of panels on walls, details of edge conditions, joints, corners, panel profiles, supports, anchorages and anchorage spacing, trim, flashings, closures and special details. Distinguish between factory and field assembly work.
- C. Samples: Submit samples for verification purposes of roofing and wall panels. Provide sample panels 12 inches long by actual panel width, in the profile, style, color and texture indicated. Include clips, battens, fasteners, closures and other panel accessories.
- D. Lab Test Reports: Verifying the performance requirements described in Article 1.03 are met.
- E. Calculations: Signed and sealed by a California licensed Engineer clarifying fastener requirements.

1.05 QUALITY ASSURANCE

- A. Qualifications
 1. Manufacturer: Shall have minimum of 5 years experience in the manufacture of this product.
 2. Fabricator/Installer
 - a. Acceptable to manufacturer and shall have minimum 5 years experience of metal panel work similar in scope and size to this Project.
 - b. Fabricator/Installer shall assume undivided responsibility for all components of the exterior panel system including, but not limited to attachment to subconstruction, panel to panel joinery, panel to dissimilar material joinery, and joint seal associated with the panel system.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Acceptance at Site: Deliver panels and other components so they will not be damaged or deformed. Package roofing and wall panels for protection against transportation damage.
- B. Handling: Exercise care in unloading, storing, and erecting roofing and wall covering panels to prevent bending, warping, twisting, and surface damage.
- C. Storage and Protection: Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal roofing and wall panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.07 PROJECT CONDITIONS

- A. Field Measurements: Where possible, prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.

1.08 WARRANTY

- A. Finish Warranty: Furnish panel manufacturer's written warranty covering failure of the factory-applied exterior finish on metal roofing and wall panels within the warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.
 - 1. Warranty period for factory-applied exterior finishes on roofing and wall panels is 20 years after the date of Substantial Completion, Beneficial Occupancy or Notice of Completion, whichever is earlier.

PART 2 - PRODUCTS**2.01 METAL PANELS**

- A. Acceptable Manufacturer: Western States Metal Roofing, or approved equal.
 - 1. Configurations
 - a. Type 1: Pre-weathered 7/8-inch corrugated Corten roof and wall panels.
 - b. Type 2: Pre-finished GSM T-groove flat wall panels, as manufactured by Western States Metal Roofing, "T-Groove Flush Wall Panel", or approved equal.

2.02 MATERIALS

- A. Gypsum Sheathing: As specified in Section 09 29 00.
- B. Underlayment at Roofing Panels: High-temperature rated peel and stick roof underlayment; high tensile strength; 12 months UV-resistant; sticks without primer; all temperature performance; light grey surface that doesn't expand or contract; double-coated splite releaser liner; 48-inch wide roll.
 - 1. Product: As manufactured by Sharkskin Roof Underlayment, "Sharkskin Ultra SA", or approved equal.
- C. Weather-Resistive Barrier at Siding Panels: As specified in Section 07 27 10.
- D. Corten (Weathering) Steel: ASTM A606, Type 4, high-strength, low-alloy steel designed to form a stable, rust-like, protective patina when exposed to the elements, eliminating the need for painting.

- E. Galvalume Steel Sheet: 0.55 Aluminum-Zinc-Alloy-Coated Steel Sheet (Zincalume): ASTM A792, Class AZ-50 coating, Grade 40; structural quality.
 - 1. Gauge: 20 gauge or 24 gauge, as indicated.
 - 2. Texture: Smooth.
- F. Panel Trims and Custom Extrusions: Manufacturer's standard, as indicated on the Drawings.
- G. Panel Supports and Anchorage: Panel manufacturer's standard.
- H. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs and other suitable fasteners designed to withstand design loads.
 - 1. Stainless Steel Fasteners: 300 series stainless steel, sharp point, 1/2-inch diameter aluminum EPDM bonded washer, size as required for application, color to match roof and siding panels, as manufactured by Levi's Building Components, "Fastgrip #9", or approved equal.
 - a. Provide aluminum or corrosion-resistant steel fasteners where required.
 - 2. Concealed Fasteners: Corrosion-resistant steel screws, #10 x 1-inch long, pancake head, Phillips drive. Use self-drilling, self-tapping for metal substrate or A-point for plywood substrate.
 - 3. Provide metal-backed neoprene washers under heads of concealed fasteners bearing on weather side of panels.
 - 4. Locate and space concealed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.
- I. Accessories: Except as indicated as work of another Section, provide components required for a complete roofing and wall panel system, including trim, copings, fascias, mullions, sills, corner units, clips, seam covers, flashings, louvers, sealants, gaskets, fillers, closure strips and similar items. Match materials and finishes of panels.
 - 1. Hat and Z Channels: Hat- and Z-shaped, stainless steel furring channels, thickness and depth as indicated, as manufactured by Eagle Mouldings; McElroy Metal, or approved equal.
 - a. Provide aluminum at and Z channels where required.
 - 2. Closure Strips: Closed-cell, self-extinguishing, expanded cellular rubber or cross-linked polyolefin foam flexible closure strips. Cut or premold to match configuration of wall panels. Provide closure strips where indicated or necessary to ensure weathertight construction.
 - 3. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
 - 4. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as recommended by the panel manufacturer.
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC Paint 12, compounded for 15-mil dry film thickness per coat.

2.03 PANEL FABRICATION

- A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as required to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensional requirements and with structural requirements.

- B. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials that are noncompatible or could result in corrosion or deterioration of either material or finishes.
- C. Fabricate panel joints with captive gaskets or separator strips, which provide a tight seal and prevent metal-to-metal contact in a manner that will minimize noise from movements within panel system.
- D. Roof and Wall Panels: Fabricate panel face sheets to the profile or configuration indicated in the Drawings and below:
 - 1. Type 1: 7/8-inch corrugated Corten.
 - 2. Type 2: GSM T-groove flat.

2.04 METAL FINISHES

- A. General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to protect the finish properly. Furnish air-drying spray finish in matching color for touch-up.
- B. Aluminum Finish: 2-coat minimum PVDF system that meets or exceeds requirements of AAMA 2605.
 - 1. Color: as selected by the Architect.

PART 3 - EXECUTION

3.01 INSTALLATION OF GYPSUM SHEATHING AND WEATHER-RESISTIVE BARRIER

- A. Gypsum Sheathing: Installation as specified in Section 09 29 00.
- B. Install 1 layer of weather-resistive barrier; weatherlap horizontal edges 4 inches minimum and vertical edges 6 inches minimum; fasten in place. Refer to Section 07 27 10.

3.02 INSTALLATION OF PANEL SUPPORTS AND ANCHORAGE

- A. Girts, angles and other secondary structural panel support members and anchorage shall be installed in accordance with AISC Manual of Steel Construction "Code of Standard Practice".

3.03 INSTALLATION OF PANELS

- A. General: Comply with manufacturer's instructions and recommendations for installation, as applicable to Project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement.
 - 1. Field cutting of exterior panels by torch is not permitted.
 - 2. Install panels with concealed fasteners.
- B. Accessories: Install components required for a complete roofing and wall panel system, including trim, copings, fascias, mullions, sills, corner units, clips, seam covers, flashings, louvers, sealants, gaskets, fillers, closure strips and similar items.
- C. Joint Sealers
 - 1. Install panels with "dry joint" system but caulk joints around aluminum framed storefronts and at soffits.

2. Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of panel systems. Provide types of gaskets, sealants, and fillers indicated or, if not otherwise indicated, types recommended by panel manufacturer.
 3. Refer to Section 07 92 00 for product and installation requirements applicable to indicated joint sealers.
- D. Install roofing and wall panels in accordance with the manufacturer's requirements and the Drawings.
- E. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- F. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4-inch in 20 feet on level/plumb/slope and location/line as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.04 CLEANING AND PROTECTION

- A. Damaged Units: Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.
- B. Cleaning: Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

END OF SECTION

SECTION 07 54 19**POLYVINYL CHLORIDE (PVC) ROOFING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Polyvinyl chloride (PVC) fully-adhered roofing system.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 07 21 01 - Building Insulation: Provision of general building insulation.
 - 2. Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of sheet metal flashing and trim.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - 2. C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 3. D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
 - 4. D4434 - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing.
- B. CBC - California Building Code, 2022 Edition
- C. EnergySmart
- D. FMG - FM Global
 - 1. Approval Guide.
 - 2. 4470 - Class I Roof Covers.
- E. OSHA - Occupational Safety and Health Administration
- F. UL - Underwriters Laboratories Inc.
 - 1. BMD - Building Materials Directory.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements: Provide anchorage of roofing system to withstand windload pressure and suction in accordance with CBC.
- B. Performance Requirements
 - 1. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
 - a. Fire/Windstorm Classification: Class 1A-70.
 - b. Hail Resistance: SH.

2. Provide roofing system that:
 - a. Arrests water migration from entering building through the roof membrane.
 - b. Conforms to manufacturer's specifications which are consistent with roofing system specified and construction conditions.
 - c. Work of this Section to conform to manufacturer's instructions.
3. Wind Load: Roofing shall withstand dead loads and live loads caused by pressure and suction of wind for design pressure in pounds per square foot in accordance with CBC and the following:
 - a. Exposure: B.
 - b. Wind Speed in Miles Per Hour: 70.
 - c. LW: 1.0.

1.04 SUBMITTALS

- A. Product Data: Submit data completely describing products including the following:
 1. Requirements for substrate preparation, temperature and humidity and other items required for successful completion of the work.
 2. Details of laps, joints, penetrations, seals, expansion joints, flashing and similar items.
 3. Application procedures.
 4. Submit material safety data sheets.
- B. Shop Drawings: Show area of waterproofing and details of flashing methods for penetrations and terminations. Drawings shall bear written authorization of membrane manufacturer's technical department.
- C. Samples
 1. Submit 12-inch square samples of sheet and roll products proposed for use on Project.
 2. Submit 4 fasteners of each type.
 3. Submit 2 walkway pads of each type for approval of color.
- D. Quality Control Submittals
 1. Certificates
 - a. List materials used in manufacturer's systems and certify compliance with standards designated.
 - b. Applicator's Qualification: Prior to start of work submit evidence that roofing materials manufacturer has certified applicator to install work to be guaranteed for both materials and workmanship.
 - c. Statement of Application: Upon completion, submit signed written statement stating that single-ply roofing system complies with the Drawings and Specifications, and that installation methods comply with manufacturer's printed instructions and were proper and adequate for conditions of installation and performance.
 2. Manufacturer's Instructions: Submit manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

- A. Qualifications
 1. Manufacturer: A qualified manufacturer that has FMG approval for membrane roofing system identical to that used for this Project and has minimum 5 years experience in manufacturing membrane roofing system.
 2. Applicator: Applicator shall have not less than 3 years successful experience in installation of polyvinyl chloride (PVC) roofing and shall have been trained and approved by the manufacturer of the PVC roofing and shall submit evidence of such certification.

- B. Regulatory Requirements: Fire hazard classification UL BMD, Class A, and FMG I-90. Minimum Class A established through testing in accordance with CBC. UL listed or approved equal.
- C. Pre-Installation Conferences
 - 1. Contractor, Applicator, and Manufacturer Review: The Contractor and applicator shall review the Contract Documents with agent of single-ply membrane waterproofing materials manufacturer and obtain agent's agreement that selected systems are proper, compatible and adequate for application shown and that conditions and details do not conflict with manufacturer's roofing and flashing bond.
 - 2. Pre-application Conference: The Contractor shall arrange conference to be attended by the Owner's Representative, the Contractor and applicator and manufacturer's agent, all of whom shall have at least 30 days notice. Conference shall be held at jobsite. The purpose of the meeting shall be to discuss requirements of storage and handling, protection measures, materials and application specifications and to determine procedures, methods and responsibilities so that conflicts may be avoided and ensure that roofing will be installed in accordance with the requirements indicated.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping
 - 1. Labels: Clearly label materials, with specification requirements including inspection agency approvals where required.
 - 2. Do not allow materials to be exposed to any moisture during transportation, storage, handling and installation. Only dry materials shall be used in the work. Mark damp or wet materials, including felts which froth or foam during installation, and remove from the site within 24 hours.
 - 3. Deliver materials in sufficient quantity to allow continuity of work.
- B. Acceptance at Site: Deliver, store and handle packaged materials in original containers with seals unbroken and labels intact until time of use.
- C. Storage and Protection
 - 1. Store rolled goods lying down and fully protected from moisture with clean canvas tarpaulins.
 - 2. Store bonding adhesives at temperatures above 40 degrees Fahrenheit.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements
 - 1. Do not install materials under adverse weather conditions without manufacturer's advice and authorization.
 - 2. Do not install more roofing inclusive of flashing than can be made watertight each day.
 - 3. Ensure surfaces to receive new membrane or flashings are dry.
 - 4. Secure new and temporary construction, including equipment and accessories against wind blow-off or damage.
 - 5. Temporary Waterstops: Install at end of each day's work and remove before proceeding with next day's work.
 - 6. Precautions should be taken when using adhesives at or near rooftop vents or air intakes. Adhesive smells may enter the building. Coordinate vents and air intakes to be closed or shut off during roofing and flashing operations in the area of such penetrations.
 - 7. Comply with all applicable environmental laws and regulations.

- B. Protection
 - 1. Provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas.
 - 2. Prior to and during application, remove dirt, debris and dust from surfaces either by vacuuming, sweeping, blowing with compressed air or similar methods.
 - 3. Liquid materials such as solvents and adhesives: Store and use away from open flames, sparks, and excessive heat.
 - 4. Do not permit contaminants such as grease, fats, oils, and solvents to come into direct contact with membrane. Identify any unusual exposures to membrane manufacturer for assessment of impact on system performance.
 - 5. When staging material on roof and during application, ensure that overloading of deck and structure does not occur.
- C. Safety
 - 1. Strictly observe safety precautions, and erect temporary barricades, warning lines, signs, and protective railings to protect persons in, around, and under the work areas.
 - 2. Dropping or throwing of objects from the roof is prohibited.
 - 3. Conform to all applicable OSHA rules and regulations, State Safety Regulations, and Orders.

1.08 SEQUENCING AND SCHEDULING

- A. Be responsible for coordinating work of this Section with related work under other Sections as required to avoid delays and prevent omission of related work required for correct installation.
- B. Single-Ply Roofing Membrane Systems: Install when construction has progressed to the point where construction activity on roof would not threaten integrity of membrane or otherwise damage completed roofing installation. Provide membrane protection as may be required to accommodate construction activity after installation of permanent roof membrane.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
 - 1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, fasteners, walkway products and other components of membrane roofing system.
 - 2. Warranty Period: 25 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 Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, fasteners, cover boards, and walkway products, for the following warranty period:
 - 1. Warranty Period: 3 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Sika Sarnafil, A Division of Sika Corporation, "G410-60 Feltback, EnergySmart", or approved equal.

- B. Except as approved by the Architect, roofing and flashing materials shall be manufactured by or be acceptable to the roofing system manufacturer.

2.02 MATERIALS

- A. General: Fully adhered single-ply roofing membrane system over insulation.
- B. Single-Ply Polyvinyl Chloride Sheet Membrane: ASTM D4434, 60 mils thick.
 - 1. Color: Bronze.
- C. PVC-Clad Flashing: PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles; color Bronze to match.
 - 1. Product: As manufactured by Sika Sarnafil, A Division of Sika Corporation, "Sarnaclad", or approved equal.
- D. Typical Metal Flashing: As specified in Section 07 62 00.
- E. Adhesive: Manufacturer's standard VOC compliant adhesive for polyvinyl chloride sheet roofing membrane.
- F. Sealant: As recommended by roofing membrane manufacturer.
- G. Prefabricated Details: Inside/outside corners and vent pipe boots as manufactured by Sarnafil, or approved equal.
- H. Fasteners for Membrane and Membrane Flashing Attachment: Corrosion resistant, as recommended by roofing membrane manufacturer.
- I. Roof Sheathing: As manufactured by Georgia Pacific, "Dens Deck Roof Board", or approved equal.
- J. Roof Walkway Pads: Flexible, factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads, approximately 3/16-inch thick, and acceptable to membrane roofing system manufacturer.
 - 1. Color: As selected by the Architect from roofing manufacturer's standard range.
 - 2. Quantity: Provide pads to serve all mechanical equipment and exhaust fans. Adjust quantity and locations shown on the Drawings to the as-built condition as required to serve all equipment and fans at not additional cost to the Owner.
- K. Vapor Retarder: Polyethylene Vapor Retarder: ASTM D4397, 6 mils thick, minimum, with maximum permeance rating of 0.13 perm.
 - 1. Tape: Pressure-sensitive tape of type recommended by roofing manufacturer for sealing joints and penetrations in vapor retarder.

2.03 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: Provide ASTM C1289, Type I, Class 1 aluminum foil facer on both major surfaces, as manufactured by Sarnafil; Johns Manville International, Inc.; GAF Materials Corporation, or approved equal.
 - 1. Provide built-up sloped rigid insulation with thickness as indicated on the Drawings.

- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4-inch per 12 inches, unless otherwise indicated.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- E. Cover Board: ASTM C1177, glass-mat, water-resistant gypsum substrate, 1/4-inch thick, as manufactured by Georgia Pacific Corporation, "Dens-Deck Prime Roof Board", or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine new substrates to verify clean, smooth, sound surfaces free from excessive roughness, oil and grease, contaminated surfaces, or unsound surfaces. Sharp ridges or other projections above the surface shall be removed before roofing.
- B. All roof surfaces shall be free from water.
- C. Adhesion/moisture testing shall be performed prior to application of roofing.
- D. Consult with roof membrane manufacturer if substrate is exposed to excessively high humidity conditions and/or corrosive environment.
- E. Do not begin installation until unsatisfactory conditions have been corrected.

3.02 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 conductors 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.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Install roof sheathing in accordance with manufacturer's written installation instructions.

3.03 VAPOR-RETARDER INSTALLATION

- A. Loosely lay polyethylene-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively.
 - 1. Seal side and end laps with tape.

3.04 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install 1 or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4-inch with insulation.
- G. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure 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 FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Install subsequent layers of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
 - 3. No insulation fasteners shall be visible at exposed steel decking.
- H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
 - 1. Fasten according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.

3.05 APPLICATION

- A. Adhesive
 - 1. Apply adhesive in accordance with manufacturer's instructions.
 - 2. Adhesive shall be applied in a smooth, even coating with no holidays, globs, puddles or similar irregularities.
 - 3. Only an area which can be completely covered in the same day's operations shall be coated with adhesive.
 - 4. Adhesive shall be allowed to dry completely prior to installing the membrane.
- B. Membrane
 - 1. Apply single-ply roofing membrane in accordance with the manufacturer's specifications, USBC, and as specified herein.
 - 2. Unroll, overlapping edge and end joints minimum 3 inches.
 - 3. Hot-air weld adjacent sheets in accordance with reviewed membrane manufacturer's written instructions.
 - 4. Use only welding equipment provided by or approved by membrane manufacturer. All mechanics using equipment shall have successfully completed instruction provided by membrane manufacturer prior to welding.
 - 5. Install mechanical fasteners on vertical parapet walls above the maximum height for adhered installation, as recommended by roofing manufacturer.
- C. Roof Walkway Pads: Install in accordance with manufacturer's written instructions.

- D. Membrane Flashings
1. Install flashings concurrently with roofing membrane as job progresses. Where flashings attach to concrete, use adhesive; where flashings attach to one another or to membrane, use hot-air welding. Ensure that no bituminous elements are in contact with membrane. Extend minimum 8 inches vertically.
 2. Hot-air weld flashings at their joints and at their connections with membrane. Hot-air weld into place preformed interior and exterior corners and miters. Ensure surfaces to be welded are clean and dry. No adhesive shall be present within lap areas.
 3. Hand Welding
 - a. Tack weld lap every 3 feet to hold seam in place.
 - b. Weld back edge of lap with thin, continuous weld to prevent loss of hot air during final welding.
 - c. Insert hot air nozzle into lap, keeping welding equipment at 45 degree angle to side lap. When proper welding temperature has been reached and material starts to flow, apply hand roller at right angle to welding gun and press lightly. For straight laps, use 1-1/2 inch nozzle; for corners and compound connections, use 3/4-inch wide nozzle.
 4. Machine Welding
 - a. Follow manufacturer's instructions when using proprietary welding equipment and observe local codes for electric supply, grounding and over current protection.
 - b. Automatic welding machines require 218 to 230 volts at 30 amps. Use of portable generator is recommended.
 5. All flashing membranes shall be mechanically attached along the top edge through predrilled metal strips.
- E. Water Cut-offs
1. Provide water cut-offs as required to prevent water from penetrating completed areas of roofing at day's end or onset of inclement weather. Be responsible for integrity of such cut-offs.
 2. Remove cut-offs prior to resumption of work and clean or remove any membrane contaminated by cut-off materials.

3.06 FIELD QUALITY CONTROL

- A. Welded Seams: The Contractor shall:
1. Check completed welded seams after cooling for continuity using screwdriver or other suitable blunt object.
 2. Be alert to visible evidence of positive welding while welding is proceeding such as smoke during welding, shiny membrane surfaces, and uninterrupted flow of black material from edge of completed joints.
 3. Take 2-inch wide cross-section samples through completed seams; patch test cut at no additional cost to the Owner.
- B. Flood Testing of Horizontal Roof for Watertightness: The Contractor shall:
1. Provide dams at appropriate points, plug scuppers, fill area to be tested with water to 2 inch depth where practicable and maintain water level for not less than 24 hours.
 2. Where testing results in leakage, drain water, make repairs as required and retest until able to demonstrate repairs, watertightness of membrane and conformance with specifications.
- C. The Owner's Inspector will continuously observe roofing operations specified under work of this Section, verify compliance with the Contract Documents, verify results of flood testing and provide the Owner daily written accounts of work progress and results of flood testing.

3.07 CLEANING

- A. Clean, restore and replace as required areas stained, dirtied, discolored or otherwise damaged due to work.
- B. Remove periodically during the work and at completion trash and debris and dispose of legally off the site.

3.08 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <Insert name> of <Insert address>, 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 <Insert wind speed> 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's Representative.
 - 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's Representative 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's Representative 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's Representative 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's Representative 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's Representative 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 the Owner from other remedies and resources lawfully available to the 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 the Owner or a subcontract with the Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.
1. Authorized Signature: <Insert signature.>
 2. Name: <Insert name.>
 3. Title: <Insert title.>

END OF SECTION

SECTION 07 62 00**SHEET METAL FLASHING AND TRIM****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Galvanized steel flashing to replace existing where indicated on the Drawings.
 - 2. Pre-finished aluminum flashing where indicated on the Drawings.
 - 3. Pre-finished aluminum sheet metal flashing to match storefront mullions.
 - 4. Pre-finished aluminum brake metal closure pieces where indicated on the Drawings.
 - 5. Pre-finished stainless steel flashing where indicated on the Drawings.
 - 6. Pre-finished corten steel flashing where indicated on the Drawings.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 05 50 00 - Metal Fabrications: For protection of dissimilar materials.
 - 2. Section 07 40 00 - Roofing and Siding Panels: Provision of metal panels at exterior.
 - 3. Section 07 54 19 - Polyvinyl Chloride (PVC) Roofing: Provision of PVC roofing system.
 - 4. Section 07 65 00 - Flexible Flashing: Provision of flexible flashing.
 - 5. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts: Provision of aluminum-framed entrances and storefronts.
 - 6. Section 09 90 00 - Painting and Coating: For finish painting.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 3. B32 - Standard Specification for Solder Metal.
 - 4. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 5. D2822 - Standard Specification for Asphalt Roof Cement.
- B. AWS - American Welding Society
- C. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc.
 - 1. Architectural Sheet Metal Manual.
- D. SSPC - The Society for Protective Coatings
 - 1. Paint 12 - Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements
 - 1. Work of this Section shall physically protect roofing and other items as indicated from damage that would permit water leakage to building interior.
 - 2. Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement and exposure to weather without failing.

3. Install sheet metal at all 90-degree transitions where waterproofing is applied from horizontal to vertical surfaces.
4. Apply sheet metal sill pans at doors where indicated.

1.04 SUBMITTALS

- A. Shop Drawings: Submit shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
- B. Finish Samples: Submit samples for verification purposes of pre-finished aluminum sheet metal flashing with PVDF paint finish.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Stainless Steel: ASTM A666, Type 304, thickness as required for the application specified, pre-finished as selected by the Architect.
- B. Aluminum: ASTM B209, Alloy 3003, 3004, 3105, or 5005, temper suitable for forming and structural performance required, but not less than H14.
 1. Thickness: 18 gauge (0.0403-inch) or as required for the application specified.
 2. Finishes
 - a. Pre-finished aluminum flashing where indicated on the Drawings.
 - b. Pre-finished aluminum sheet metal flashing to match storefront mullions, as specified in Section 08 41 13.
 - c. Prefinished aluminum brake metal closure pieces where indicated on the Drawings.
- C. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A653, G90 hot-dip galvanized, 24 gauge unless otherwise indicated.
 1. Finish: Pre-finished to match roofing and siding panels, as specified in Section 07 40 00.
- D. Miscellaneous Materials and Accessories
 1. Solder and Flux
 - a. For use with aluminum, provide ASTM B32, re-melted or reworked solder will not be permitted.
 - b. For use with steel, provide 50 - 50 tin/lead solder, ASTM B32, with rosin flux. Re-melted or reworked solder will not be permitted.
 - c. For use with stainless steel, provide ASTM B32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 2. Fasteners: Same metal as flashing/sheet metal or other noncorrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
 3. Bituminous Coating: SSPC Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coat.
 4. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.
 5. Flexible Flashing: As specified in Section 07 65 00.
 6. Flexible Flashing Filler: Closed-cell polyethylene or other soft closed cell material recommended by flexible flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
 7. Roofing Cement: ASTM D2822, asphaltic.

- E. Materials for Permanent Protection of Dissimilar Materials: As specified in Section 05 50 00.
- F. Finish Painting Where Required: As specified in Section 09 90 00.

2.02 FABRICATION

- A. Shop Assembly
 - 1. Design and fabricate work in accordance with SMACNA, unless otherwise indicated.
 - 2. As far as practicable, form and fabricate sheet metal in shop. Where on-site fabrication is required, provide work equal to shop quality. Additionally, identify bulk materials from which items are field fabricated by manufacturer's trademark printed or embossed at frequent intervals.
 - 3. Reproduce accurately profiles and bends indicated.
 - 4. Provide profiles with interactions that are sharp, even and true; with plane surfaces free from buckles and waves; and seams that follow direction of water flow.
 - 5. Reinforce correctly for strength and appearance.
 - 6. Cut, fit, and drill sheet metal as required to accommodate related, adjacent or adjoining work.
 - 7. Exposed Edges of Sheet Metal: Fold, bend or return exposed edges of sheet metal. Raw edges will not be permitted.
 - 8. Form pieces in longest practical lengths.
- B. Sheet Metal Joints
 - 1. In general, provide lock joints; where impractical, lap, rivet, solder, or weld joints, or join as otherwise recommended by manufacturer.
 - 2. Join joints and miters as recommended by manufacturer.
 - 3. Where positive joining is required, weld in accordance with applicable AWS standards.
 - 4. Turn lock joints on exposed surfaces in direction of flow.
- C. Soldering
 - 1. Neatly solder exposed surfaces.
 - 2. Pre-tin edges minimum 1-1/2 inches both sides prior to soldering.
 - 3. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.
 - 4. Solder all corners and joints where waterproofing is to be applied.
- D. Expansion and Contraction of Sheet Metal Runs: Provide loose locking slip joint of maximum 8 feet from external and internal corners, maximum 24 feet length of straight runs, unless manufacturer recommends more frequent interval, and 1 at center of runs less than 20 feet, but more than 8 feet, unless specified otherwise following herein.
- E. Provide the following items of materials and minimum gauges as indicated:
 - 1. Cleats: Formed of same metal as that being anchored, with size 1-1/2 times larger in gauge, shape, and quantity as required to secure flashing and sheet metal work in place.
 - 2. Base Flashing, Counter Flashing and Roof Penetration Flashing
 - a. Formed with 3/4-inch locked and soldered seams, assembled into units not longer than 16 feet.
 - b. Join units with 3/4-inch wide loose locked seams filled with soft grade butyl base compound, before units are assembled.
 - c. Mitre corners and joints by riveted or locked and soldered joints.
 - 3. At all vertical to horizontal transitions in waterproofing, provide minimum 8-inch high by 4-inch wide "L" metal flashing. Secure no greater than 6 inches on center at horizontal flange.
 - 4. Sub-Sill Flashings and Sheet Metal Drip Screeds: Continuous, sizes and shapes as indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Conform with procedures and methods of installation and applicable details shown and described in SMACNA Manual.
- B. Where installation requires fabrication at the Project site, conform to applicable requirements of Article titled "Fabrication" in this Section.
- C. Install standard catalog products in accordance with manufacturer's instructions, unless otherwise indicated.
- D. Install work watertight; ensure that items are installed in true and accurate alignment with other items and related work, that joints are accurately fitted, that corners are reinforced and that exposed surfaces are free of dents.
- E. Apply flashing compound at slip joints or wherever metal-to-metal contact occurs and movement may be anticipated to occur.
- F. Flashings
 - 1. Fasten sheet metal runs to underlaying material by nailing through slotted holes in flange at 3 inches on center, unless otherwise indicated or required by manufacturer.
 - 2. Provide waterproof washers wherever fasteners penetrate flashings.

3.02 ADJUSTING

- A. Replace damaged material with new.

END OF SECTION

SECTION 07 65 00**FLEXIBLE FLASHING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Flexible membrane flashing as detailed in the Drawings.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of sheet metal flashing and trim.
 - 2. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts: Provision of aluminum-framed entrances and storefronts.
 - 3. Section 08 90 00 - Louvers and Vents: Provision of louvers and vents.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's most current product data and installation instructions, including manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and data for physical and performance properties.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer approved by flexible flashing membrane manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection
 - 1. Store materials in their original undamaged packages in clean, dry protected location and within temperature range required by flexible flashing membrane manufacturer.
 - 2. Protect stored materials from direct sunlight.

1.05 PROJECT CONDITIONS

- A. Environmental Requirements: Do not apply to moist or damp surfaces.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Flexible Flashing at Sheet Metal Flashings and Window and Door Openings and Penetrations: Self-sealing, self-healing, fully adhered, composite flexible flashing. Flashing shall be 25 mil minimum thickness sheet consisting of rubberized asphalt integrally bonded to a high density, cross-laminated polyethylene film. The rolls shall be interwound with a disposable silicone-coated release sheet. Flashing shall be from rolls of 12-inch width.
 - 1. Product: As manufactured by GCP Applied Technologies, "Vycor Plus", or approved equal.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions under which flexible flashing will be applied, with installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Installation constitutes acceptance of substrate condition.

3.02 INSTALLATION

- A. Install flexible flashing in strict accordance with manufacturer's written instructions.
- B. Use elastomeric flashing compound compatible with rubberized asphalt at exposed lap joints where water intrusion could occur.
- C. Surface shall be smooth, clean, dry and free of voids or other conditions hindering adhesion or regularity of flashing installation. Clean loose dust or dirt from the surface wherever wall flashing is to be applied by wiping with a clean dry cloth or brush.
- D. Test surfaces for proper adhesion. Use manufacturer's recommended surface conditioner if substrate or conditions hinder proper adhesion of flashing membrane.
- E. Cut membrane to size and peel release paper from roll to expose rubberized asphalt and position against surface. Press firmly into place with a steel hand roller, fully adhering the flashing to the substrate. Where the steel hand roller will not fit, e.g. tight inside corners, the back of a utility knife, fully adhering the flashing to tight corners and folds, may be used.
- F. Overlap adjacent pieces 2 inches and roll overlap with a steel hand roller.
- G. Rubberized asphalt flashing shall not be applied in areas where it will be exposed to direct sunlight. In all cases, flashing shall be covered within 30 days after installation.
- H. Install flashing at wall in openings in accordance with approved field mockup and in accordance with details.
- I. Ensure that flexible flashing adheres continuously to substrate, and is free from bubbles, fishmouths, creases and other irregularities that affect monolithic adhesion.
- J. Carefully notch and fold flexible flashing at corners and returns. Provide additional overlapping pieces as required for watertight installation.

END OF SECTION

SECTION 07 92 00**JOINT SEALANTS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Joint sealants and backing systems for the following locations:
 - 1. Exterior joints in vertical surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete.
 - b. Perimeter joints between cast-in-place concrete and frames of doors and windows.
 - c. Control and expansion joints in soffit and overhead surfaces.
 - d. Other joints as indicated.
 - 2. Exterior joints in horizontal traffic surfaces as indicated below:
 - a. Control, expansion and isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.
 - 3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
 - a. Perimeter joints of exterior openings where indicated.
 - b. Tile control and expansion joints.
 - c. Other joints as indicated.
 - 4. Interior joints in horizontal traffic surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - c. Other joints as indicated.
 - 5. Acoustical sealant for concealed joints.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 04 43 00 - Stone Masonry: Provision of stone masonry.
 - 2. Section 05 45 00 - Metal Support Assemblies: Provision of metal support assemblies.
 - 3. Section 07 40 00 - Roofing and Siding Panels: Provision of metal panels at exterior.
 - 4. Section 08 11 16 - Aluminum Doors and Frames: Provision of aluminum doors and frames.
 - 5. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts: Provision of aluminum-framed entrances and storefronts.
 - 6. Section 09 29 00 - Gypsum Board: For sealants used in concealed perimeter joints of gypsum board partitions to reduce sound transmission.
 - 7. Section 09 30 00 - Tiling: Provision of ceramic tile.
 - 8. Section 09 65 00 - Resilient Flooring: Provision of resilient flooring.
 - 9. Section 12 36 61.16 - Solid Surfacing Countertops: Provision of solid surfacing countertops.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. C834 - Standard Specification for Latex Sealants.
 - 2. C919 - Standard Practice for Use of Sealants in Acoustical Applications.
 - 3. C920 - Standard Specification for Elastomeric Joint Sealants.
 - 4. C1193 - Standard Guide for Use of Joint Sealants.
 - 5. D217 - Standard Test Methods for Cone Penetration of Lubricating Grease.

- 6. D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
- 7. D2240 - Standard Test Method for Rubber Property - Durometer Hardness.
- B. CALGreen - California Green Building Standards, 2022 Edition
- C. FS - Federal Specifications
 - 1. TT-S-001543 - Sealing Compound, Silicone Rubber Base.

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide joint sealers that have been manufactured to establish and maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- B. Sealants used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Article 5.504.4.1.

1.04 SUBMITTALS

- A. Product Data: Submit product data from manufacturers for each joint sealant product required.
- B. Samples: Submit samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing color to match adjacent surface, for each product exposed to view.
- C. Quality Control Submittals
 - 1. Test Reports
 - a. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
 - b. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.
 - c. Preconstruction field test reports indicating which products and joint preparation methods demonstrate acceptable adhesion to joint substrates.
 - 2. Certificates
 - a. Submit certification by joint sealant manufacturers that sealants plus the primers and cleaners required for sealant installations comply with local regulations controlling use of volatile organic compounds.
 - b. Submit certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed joint sealant applications similar in material, design and extent to that indicated for this Project that have resulted in construction with a record of successful in-service performance.
- B. Product Testing: Provide comprehensive test data for each type of joint sealant to be used based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24 month period preceding date of Contractor's submittal of test results to the Architect.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site: Deliver materials to the Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multicomponent materials.
- B. Storage and Protection: Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants or other causes.

1.07 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When joint substrates are wet or damp.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.08 SEQUENCING AND SCHEDULING

- A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. General Requirements
 - 1. Provide joint sealers compatible with one another and with substrates.
 - 2. Manufacturer's standard color range shall permit matching sealants to color of contacting surfaces and future ability to paint.
- B. Sealants and Caulks
 - 1. Type A - One Part Neutral Cure Silicone Sealant
 - a. ASTM C920, non-sag, one part, low modulus, elastomeric sealant.
 - b. Color: As selected by the Architect.
 - c. Product: As manufactured by Dow-Corning, "790"; Tremco Incorporated, "Spectrum 1", or approved equal.
 - 2. Type B - Polyurethane Sealant, Two Component
 - a. ASTM C920, Type M; Grade P; Class 25; Use T having minimum ASTM D2240 Shore A hardness of 30 plus or minus 5.
 - b. Color: As selected by the Architect.
 - c. Product: As manufactured by Sika Corporation, Inc., "Sikaflex 2cSL"; Sonneborn Building Products Division, "Sonolastic SL2", or approved equal.
 - 3. Type C - Acrylic Emulsion Sealant
 - a. ASTM C834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.
 - b. Color: As selected by the Architect.

- c. Product: As manufactured by Pecora Corp., "AC-20"; Tremco Incorporated, "Tremco Acrylic Latex 834", or approved equal.
- 4. Type D - Acoustical Sealant
 - a. Acoustical sealant shall be non-skinning, non-hardening, flexible sealant specifically designed for sealing gypsum wallboard. Sealant shall be capable of spanning 1/2-inch wide by 3/8-inch deep gaps. Synthetic rubber based products shall comply with ASTM D217 and acrylic latex based products shall comply with ASTM C834.
 - b. Product: As manufactured by Tremco Incorporated; USG Acoustical Sealant; Pecora, "AC-20 FTR", or approved equal.

2.02 ACCESSORIES

- A. Primer: Non-staining type recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056 round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width as recommended by manufacturer of sealant material.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.
- E. Backer Rod at Acoustical Sealant: Flexible closed cell, neoprene rod or polyethylene foam suitable for use as a backer to the acoustic sealant. Width of backer rod shall be a minimum of 30 percent greater and a maximum of 50 percent greater than the joint width.
- F. Sheet Caulking for Junction Boxes
 - 1. At Non-Fire Rated Assemblies: As manufactured by Lowry's, "Lowry's Electrical box Sealer"; Tremco Incorporated, "Sheet Caulking", or approved equal.
 - 2. At Fire Rated Assemblies: As manufactured by Hevi-Duty/Nelson, "Firestop Putty Pads"; Specified Technologies, Inc.; Hilti, "CP-617", or approved equal.

PART 3 - EXECUTION

3.01 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. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer 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 and surface dirt.

2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, 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 from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 3. Remove laitance and form release agents from concrete.
 4. Clean metal, glass, glazed surfaces of ceramic tile and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant 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.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.
1. Apply expanding foam sealant where detailed and where multiple pipes or conduits penetrate sound rated construction.
- D. Installation of Sealant Joint Backings: Install sealant joint backings to comply with the following requirements:
1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
 2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

- F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 1. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.04 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they 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 that and installations with repaired areas are indistinguishable from original work.

3.06 SCHEDULE

- A. Type A, Non-Sag
 - 1. Exterior and interior control and expansion joints in vertical surfaces of cast-in-place concrete.
 - 2. Between metal and concrete or mortar.
 - 3. Interior and exterior perimeter joints between cast-in-place concrete and frames of doors and windows.
 - 4. Control and expansion joints in exterior soffits and overhead surfaces.
- B. Type B: Exterior control, expansion and isolation joints in cast-in-place concrete slabs.
- C. Type C: All other interior joints not indicated otherwise.
- D. Type D: Concealed acoustical conditions.

END OF SECTION

SECTION 08 11 16**ALUMINUM DOORS AND FRAMES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Non-fire resistance rated aluminum doors and frames.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 05 50 00 - Metal Fabrications: For protection of dissimilar materials.
 - 2. Section 07 92 00 - Joint Sealants: Provision of sealers and caulks.
 - 3. Section 08 14 16 - Flush Wood Doors: Provision of flush wood doors.
 - 4. Section 08 71 00 - Door Hardware: Provision of door hardware.
 - 5. Section 08 80 00 - Glazing: For glazing standards.

1.02 REFERENCES

- A. ANSI - American National Standards Institute
 - 1. A156.16 - Auxiliary Hardware.
- B. ASTM - American Society for Testing and Materials
 - 1. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 3. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 4. B211 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
 - 5. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 6. B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - 7. D2000 - Standard Classification System for Rubber Products in Automotive Applications.
 - 8. D2287 - Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
- C. AWS - American Welding Society
 - 1. A5.10 - Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.
 - 2. D1.2 - Structural Welding Code - Aluminum.
- D. BHMA - Builders Hardware Manufacturers Association
 - 1. A156.16 - Auxiliary Hardware.
- E. NAAMM - National Association of Architectural Metal Manufacturers
 - 1. MFM - Metal Finishes Manual for Architectural and Metal Products.

1.03 SYSTEM DESCRIPTION

- A. General: Provide aluminum doors and frames capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

- B. Dimensional Tolerances: Provide aluminum doors and frames that accommodate dimensional tolerances of building frame and other adjacent construction.

1.04 SUBMITTALS

- A. Product Data: Submit product data for each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.

1.05 QUALITY ASSURANCE

- A. Welding Standards: Comply with applicable provisions of AWS D1.2.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Wilson Partitions, or approved equal.

2.02 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
 - 1. Sheet and Plate: ASTM B209.
 - 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B429.
 - 4. Bars, Rods, and Wire: ASTM B211.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10.
- B. Glazing Gaskets: EPDM elastomeric extrusions.
- C. Protection of Dissimilar Materials: As specified in Section 05 50 00.

2.03 COMPONENTS

- A. Doors: Provide manufacturer's standard 1-3/4 inch thick glazed doors with minimum 0.125-inch thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
 - 1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded aluminum glazing stops and preformed gaskets.
- B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide non-staining, non-ferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
 - 1. Reinforce members as required to retain fastener threads.
 - 2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

- D. Concrete Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123 or ASTM A153 requirements.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.
- F. Compression Weather Stripping: Manufacturer's standard replaceable molded neoprene complying with ASTM D2000 requirements or molded PVC complying with ASTM D2287 requirements.
- G. Hardware: As specified in Section 08 71 00.
- H. Glass and Glazing Materials: As specified in Section 08 80 00.

2.04 FABRICATION

- A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
 - 1. Fabricate components for screw-spline frame construction.
- B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- C. Prepare components to receive concealed fasteners and anchor and connection devices.
- D. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. 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.
- E. Metal Protection: 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. Where aluminum will contact concrete, protect against corrosion by painting contact surfaces as specified in Section 05 50 00.
- F. Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
 - 1. Interior Doors: Provide ANSI/BHMA A156.16 silencers at stops to prevent metal to metal contact. Provide 3 silencers on strike jamb of single door frames and 2 silencers on head of double door frames.

2.05 FINISHES

- A. General: Comply with NAAMM's MFM for recommendations relative to applying and designating finishes.
- 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 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.

- C. Aluminum Finish: Manufacturer's standard factory-finished powder coat system.
 - 1. Color: White.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of aluminum doors and frames. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing aluminum doors and frames. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
- B. Metal Protection: 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. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Install perimeter sealant, unless otherwise indicated. Comply with requirements of Section 07 92 00.
- D. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
- E. Install doors plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
 - 1. Install surface mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
- F. Erection Tolerances: Install aluminum doors and frames to comply with the following maximum tolerances:
 - 1. Variation from Plane: Limit variation from plane or location shown to 1/8-inch in 12 feet; 1/4-inch over total length.
 - 2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16-inch. Where surfaces meet at corners, limit offset from true alignment to 1/32-inch.
 - 3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8-inch.

3.03 ADJUSTING AND CLEANING

- A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.
- B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.04 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure aluminum doors and frames are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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SECTION 08 14 16**FLUSH WOOD DOORS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Interior non-fire resistance-rated flush solid core doors, with and without glazing.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 08 11 16 - Aluminum Doors and Frames: Provision of aluminum doors and frames.
 - 2. Section 08 71 00 - Door Hardware: Provision of finish hardware.
 - 3. Section 08 80 00 - Glazing: Provision of glass and glazing.
 - 4. Section 09 90 00 - Painting and Coating: For field painting primed doors.

1.02 REFERENCES

- A. CALGreen - California Green Building Standards, 2022 Edition
- B. DHI - Door and Hardware Institute
 - 1. A115-W - Wood Door Preparation Standards, a set containing A115-W1 - A115-W9.
 - 2. WDHS-3 - Recommended Hardware Locations for Wood Flush Doors.
- C. WDMA - Window and Door Manufacturers Association
 - 1. I.S.1-A - Architectural Wood Flush Doors.

1.03 SYSTEM DESCRIPTION

- A. Composite wood used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Articles 5.504.4.5 and 5.504.4.5.3.

1.04 SUBMITTALS

- A. Product Data: Submit product data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.
- B. Shop Drawings: Submit shop drawings indicating location and size of each door referenced to the Architect's door mark and hardware group, elevation of each kind of door, details of construction, location and extent of hardware blocking, requirements for factory finishing and other pertinent data.
 - 1. For factory-machined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light and louver openings.
- C. Samples: Corner sections of doors approximately 12 inches square with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required.

1.05 QUALITY ASSURANCE

- A. Quality Standard: WDMA Quality Standard: I.S.1-A.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Identify each door with individual opening numbers as designated on shop drawings, using temporary, removable, or concealed markings. Use the Architect's door numbering system.
- B. Storage and Protection: Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's instructions.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements: 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.

1.08 WARRANTY

- A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other 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. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4-inch in a 42 inch by 84 inch section or that show telegraphing of core construction in face veneers exceeding 0.01-inch in a 3 inch span, or do not conform to tolerance limitations of referenced quality standards.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
 - 2. Warranty shall be in effect during the following period of time after date of Substantial Completion.
 - a. Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: Algoma Hardwoods, Inc.; Eggers Industries, Architectural Door Division; Marshfield Door Systems, or approved equal.

2.02 MATERIALS

- A. Interior Non-Fire Rated Solid Core Doors
 - 1. Face and Finish, WD-2: Paint-grade poplar veneer, intended for opaque finish.
 - 2. Grade: Custom.
 - 3. Construction: 5 plies.
 - 4. Core: Structural composite lumber.

- 5. Bonding: Stiles and rails bonded to core; then entire unit abrasive planed before veneering.
- 6. Vertical Exposed Edges of Stiles: Solid stock, same species as face of doors with no finger joints, knots, pitch pockets, or other defects.
- B. Glazing: Where indicated and as specified in Section 08 80 00.
- C. Hardware: As specified in Section 08 71 00.
- D. Door Frames: Aluminum, as specified in Section 08 11 16.

2.03 FABRICATION

- A. Fabricate flush wood doors to comply with the following requirements:
 - 1. 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, DHI A115-W series standards, and hardware templates.
 - a. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory machining.
- B. Finishing: As specified in Section 09 90 00.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine installed door frames prior to hanging door.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - 2. Reject doors with defects.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Hardware: See Section 08 71 00.
- B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and referenced quality standard and as indicated.
- C. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer. Seal cut surfaces after fitting.
 - 1. Fitting Clearances for Non-Fire Resistance Rated Doors: Provide 1/8-inch at jambs and heads; 1/16-inch per leaf at meeting stiles for pairs of doors, and 1/8-inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4-inch clearance from bottom of door to top of threshold.
 - 2. Bevel non-fire rated doors 1/8-inch in 2 inches at lock and hinge edges.
- D. Field-Finished Doors: See Section 09 90 00.

3.03 ADJUSTING AND PROTECTION

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Refinish or replace doors damaged during installation.

- C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08 31 13**ACCESS DOORS AND FRAMES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Access doors and frames.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 09 29 00 - Gypsum Board: Provision of gypsum board.
 - 2. Section 09 90 00 - Painting and Coating: For finish painting.
 - 3. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Provision of access doors into ducts.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's data completely describing products.
- B. Shop Drawings: Submit drawings showing attachment to structure in each typical condition. Refer to Division 23 regarding requirements for showing locations of access doors.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Packaging and Shipping: Identify type and size of each door.
- B. Storage and Protection
 - 1. Deliver and store packaged products in original containers with seals unbroken and labels intact until time of use.
 - 2. Deliver products only after proper facilities are available; handle carefully to prevent damage and store on clean concrete surface or raised platform in safe, dry area.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: Milcor, Inc.; Karp Associates, Inc.; J. L. Industries, or approved equal.

2.02 MATERIALS

- A. Non-Fire Rated
 - 1. General: Equip with screw driver turned locks.
 - 2. Type 1: Flush steel door and flanged frame for gypsum board walls and ceiling installations; trimless model and mud-in installation required.
 - 3. Type 2: Flush stainless steel door and flanged frame for masonry, tile and gypsum board installations.
- B. Access Doors at Sound Rated Construction
 - 1. Provide doors equivalent to fire rated access door.
 - 2. Door Panel: Double wall insulated.

3. 1-1/2 inch thick minimum mineral wool insulation.
 4. Continuous piano hinge.
 5. Product: As manufactured by CESCO Products, "SFB"; Williams Brothers Corp., "WB-FR Premium", or approved equal.
- C. Finishes
1. Steel: Chemically etch and apply baked-on rust inhibitive zinc dust prime coat.
 2. Stainless Steel: Reviewed manufacturer's #4 finish.
 3. Finish Painting: As specified in Section 09 90 00.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine construction to receive access door and verify dimensions and other supporting or adjoining conditions.
- B. Do not install doors until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Coordinate details with other work supporting, adjoining or requiring access doors.
- B. Verify location of items requiring access so that access door location will be compatible with planned finishing of spaces and the location of other wall or ceiling mounted equipment or fixtures.

3.03 INSTALLATION

- A. Install access doors in accordance with manufacturer's instructions and at locations authorized by the Architect in accordance with requirements for work of Division 23.
- B. Securely attach frames to supporting work and ensure doors operate smoothly and are free from warp, twist and distortion.

3.04 ADJUSTING AND CLEANING

- A. Thoroughly clean surfaces of grease, oil, or other impurities, touch-up abraded prime coat and otherwise prepare for finish painting where required.

END OF SECTION

SECTION 08 41 13**ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Aluminum-framed entrances and storefronts.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of sheet metal flashing and trim.
 - 2. Section 07 65 00 - Flexible Flashing: Provision of flexible flashing.
 - 3. Section 07 92 00 - Joint Sealants: Provision of sealants.
 - 4. Section 08 71 00 - Door Hardware: For hardware standards.
 - 5. Section 08 80 00 - Glazing: Provision of glass and glazing.

1.02 REFERENCES

- A. AA - Aluminum Association
- B. ADA - Americans with Disabilities Act
- C. ASTM - American Society for Testing and Materials
 - 1. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - 3. B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 - 4. D523 - Standard Test Method for Specular Gloss.
- D. CBC - California Building Code, 2022 Edition
- E. NAAMM - National Association of Mirror Manufacturers
 - 1. MFM - Metal Finishes Manual for Architectural and Metal Products.
- F. SSPC - The Society for Protective Coatings
 - 1. Paint 12 - Paint Specification No. 12: Cold Applied Asphalt Mastic (Extra Thick Film).

1.03 SYSTEM DESCRIPTION

- A. Design Requirements: Provide aluminum storefront systems that comply with structural performance requirements indicated.
 - 1. Seismic Loads: Provide storefront systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to CBC.
 - 2. Deflection Normal to the Plane of the Wall: Test pressure required to measure deflection of framing members normal to the plane of the wall shall be equivalent to the wind load specified above. Deflection shall not exceed 1/360 of the clear span, when subjected to uniform load deflection test.

3. Deflection Parallel to the Plane of the Wall: Test pressures required to measure deflection parallel to the plane of the wall shall be equal to 1.5 times the wind pressures specified above. Deflection of any member carrying its full dead load shall not exceed an amount that will reduce glass bite below 75 percent of the design dimension and shall not reduce the edge clearance between the member and the fixed panel, glass or other 1 fixed member above to less than 1/8-inch. The clearance between the member and an operable door or window shall be at least 1/16-inch.
 4. Glazing: Physically isolate glazing from framing members.
 5. Glazing to Glazing Joints: Provide glazing to glazing joints that accommodate thermal and mechanical movements of glazing and system, prevent glazing to glazing contact and maintain required edge clearances.
- B. Performance Requirements: Finish hardware supplier shall be responsible for furnishing physical hardware to the entrance manufacturer prior to fabrication and for coordinating hardware delivery requirements with the hardware manufacturer, the General Contractor, and the entrance manufacturer to ensure the Project is not delayed.

1.04 SUBMITTALS

- A. Product Data: Submit product data for each aluminum storefront system required, including:
1. Manufacturer's standard details and fabrication methods.
 2. Data on finishing, hardware, and accessories.
 3. Recommendations for maintenance and cleaning of surfaces.
 4. Profiles and dimension of components.
- B. Shop Drawings: Submit shop drawings for aluminum storefront system required, including:
1. Layout and installation details, including relationship to adjacent work.
 2. Elevations at 1/4-inch scale.
 3. Detail sections of typical composite members.
 4. Anchors and reinforcement.
 5. Provisions for expansion and contraction.
 6. Glazing details.
 7. Entry door details, flashing details and other special conditions.
 8. Structural calculation for seismic and gravity loads on structural components of system. Drawings and calculations shall be by licensed engineer in the State of California and engineer shall be fully familiar with glazing systems.
- C. Samples
1. For Initial Color Selection: Submit pairs of samples of specified finish on 12 inch long sections of extrusions or formed shapes.
 2. For Verification Purposes: The Architect reserves the right to require additional samples, that show fabrication techniques and workmanship, and design of hardware and accessories.
- D. Quality Control Submittals: Provide certified test reports from a qualified independent testing laboratory showing that aluminum storefront systems have been tested in accordance with specified test procedures and comply with performance characteristics indicated.

1.05 WARRANTY

- A. Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to:

1. Structural failures including excessive deflection, excessive leakage or air infiltration.
 2. Faulty operation.
 3. Deterioration of metals, metal finishes and other materials beyond normal weathering.
- B. Warranty Period: 2 years after the date of Substantial Completion.
- C. The warranty shall not deprive the Owner of other rights or remedies the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers
1. Exterior Storefront: Kawneer Company, Inc., "451T Series", or approved equal.
 2. Entrance: Kawneer Company, Inc., "Series 500T InsulPour", or approved equal.

2.02 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070-inch wall thickness at any location for the main frame and complying with ASTM B221; 6063-T6 alloy and temper.
- B. Fasteners: Aluminum, nonmagnetic stainless steel, or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 or zinc-coated steel or iron complying with ASTM B633; provide sufficient strength to withstand design pressure indicated.
- E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement as specified in Section 07 92 00.
- F. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

2.03 STOREFRONT FRAMING SYSTEM AND TRANSOMS

- A. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed, fasteners shall be stainless steel.

- C. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- D. Glazing: As specified in Section 08 80 00.
- E. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.
- F. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- G. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.04 ENTRANCES

- A. Doors: Manufacturer's standard glazed doors for manual swing and slide operation.
 - 1. Door Construction: Minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
 - 2. Door Design: Narrow stile.
 - 3. Dimensions: 2-1/8 inch vertical face; 1-3/4 inch depth; 10-inch bottom rail.
 - 4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets; provide nonremovable glazing stops on outside of door.
 - 5. At sliding door, provide break-away function on moving pane.
- B. Hardware, General: Refer to Section 08 71 00 for hardware standards.

2.05 FABRICATION

- A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Typical Size: 2 inches by 4-1/2 inches.
 - 2. Profiles that are sharp, straight, and free of defects or deformations.
 - 3. Accurately fit joints; make joints flush, hairline and weatherproof.
 - 4. Physical isolation of glazing from framing members.
 - 5. Accommodations for mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 6. Provisions for field replacement of glazing.
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- C. Storefront Framing: Fabricate components for assembly using manufacturer's standard installation instructions.
- D. After fabrication, clearly mark components to identify their locations in Project according to shop drawings.

2.06 ALUMINUM FINISH

- A. General: Comply with NAAMM's MFM for recommendations relative to applying and designating finishes.

- 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 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.
- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. Fluoropolymer Coating: Manufacturer's standard 2 coat, thermo-cured, full-strength 70 percent "Kynar 500" or "Hylar 5000" coating consisting of a primer and a minimum 0.75-mil dry film thickness with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D523.
 - 1. Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking and fading.
 - 2. Color: As selected by the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas with the installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of storefront and entrance system. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing storefront and entrance system. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
- B. Metal Protection: 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. Where aluminum will contact concrete, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
- D. Install glazing to comply with requirements of Section 08 80 00.
- E. Erection Tolerances: Install storefront system to comply with the following maximum tolerances.
 - 1. Variation from Plane: Limit variation from plane or location shown to 1/8-inch in 12 feet; 1/4-inch over total length.
 - 2. Diagonal Measurements: Limit difference between diagonal measurements to 1/8-inch.

3.03 CLEANING

- A. Remove excess sealant and glazing compounds, and dirt from surfaces.

END OF SECTION

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SECTION 08 41 26**ALL-GLASS ENTRANCES - ALTERNATES #2 AND #4****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Interior, fixed, frameless glass panel partitions with swinging glass doors.
 - 1. Alternate #2: Provide frameless glass wall, as specified herein, at Meeting Room.
 - 2. Alternate #4: Provide frameless glass wall, as specified herein, at Children's Room.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Division 01 - General Requirements: For alternates.
 - 2. Section 08 71 00 - Door Hardware: Provision of finish hardware.
 - 3. Section 08 80 00 - Glazing: Provision of glass and glazing.

1.02 REFERENCES

- A. AAMA - American Architectural Manufacturers Association
 - 1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
- B. ABA - Architectural Barriers Act
 - 1. Accessibility Guidelines for Buildings and Facilities.
- C. ADA - Americans with Disabilities Act
 - 1. Accessibility Guidelines for Buildings and Facilities.
- D. ANSI - American National Standards Institute
 - 1. A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. A156 Series.
- E. ASCE - American Society of Civil Engineers
 - 1. 7 - Minimum Design Loads for Buildings and Other Structures.
- F. ASTM - American Society for Testing and Materials
 - 1. A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 2. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 3. E90 - Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 4. E413 - Classification for Rating Sound Insulation.
 - 5. E557 - Guide for the Installation of Operable Partitions.
- G. BHMA - Builders Hardware Manufacturers Association
 - 1. A156 Series.
- H. CFR - Code of Federal Regulations
 - 1. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

- I. ICC - International Code Council
 - 1. Accessible and Usable Buildings and Facilities.
- J. SEI - Structural Engineering Institute
 - 1. 7 - Minimum Design Loads for Buildings and Other Structures.
- K. SGCC - Safety Glazing Certification Council
- L. U. S. Architectural and Transportation Barriers Compliance Board.

1.03 SYSTEM DESCRIPTION

- A. Performance Requirement
 - 1. Acoustical Performance: Provide glass panel partition tested by qualified testing agency as follows:
 - a. Sound-Transmission Requirements: Tested for laboratory sound-transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than STC indicated.

1.04 SUBMITTALS

- A. Product Data: For each glass panel partition and door component specified, including:
 - 1. Glass panels.
 - 2. Frame and sill tracks.
 - 3. Door hardware and accessories.
- B. Shop Drawings: For fixed glass panel partitions.
 - 1. Include plans, elevations, sections, and details. Provide numbered panel installation sequence.
 - 2. Show locations and requirements for tracks, bracing, blocking, and attachments to other work.
- C. Samples for Verification: For each exposed component including hardware, for each color and finish selected, of size indicated below:
 - 1. Glass: Units 12 inches square.
 - 2. Exposed Frame, Track, and Sill Members: Not less than 6 inches long.
 - 3. Hardware: One of each type of exposed door hardware items.
- D. Qualification Data: For qualified installer.
- E. Warranty: Sample of unexecuted manufacturer warranty.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced Installer equipped and trained for installation of glass panel partitions required for this Project with record of successful completion of not less than 5 projects of similar scope.
- B. Single Source Responsibility: Provide glass panel partitions and associated hardware by a single manufacturer through a single source.

1.06 COORDINATION

- A. Coordinate installation of glass panel partitions with installation of floor, wall, and ceiling construction to comply with substrate tolerance requirements of partition manufacturer.

- B. Coordinate installation of anchors and secondary structural members indicated on approved glass panel partition shop drawings and specified in other Sections.

1.07 WARRANTY

- A. Special Manufacturer's Warranty: Standard form in which manufacturer agrees to repair or replace components of glass panel partitions that demonstrate deterioration or faulty operation due to defects in materials or workmanship under normal use within warranty period specified.
 - 1. Warranty Period: 5 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Provide glass door assemblies manufactured by dormakaba USA, Inc.; (800) 523-8483; email: specnow@dormakaba.com; website: www.dormakabakaba.us, or comparable products of other manufacturer approved by Architect in accordance with Instructions to Bidders and Division 01 General Requirements.

2.02 GLASS PANEL PARTITIONS

- A. Fixed Glass Panel Partitions: Frameless glass panel partition with top track and bottom sill guide, with butt-glazed dry joint between panels, and equipped with swinging doors where indicated.
 - 1. Basis of Design: dormakaba, PURE.
 - 2. Sound Transmission Class (STC): ASTM E90.
 - 3. Partition Top Track: Aluminum extrusion, low-profile.
 - 4. Sill Guide: Aluminum extrusion.

2.03 GLASS PANELS AND DOORS

- A. Glass Panels, General: Provide glass panels that comply with 16 CFR 1201, Category II requirements for safety glazing. Permanently mark glazing with certification label of the SGCC.
 - 1. Glass and Door Panel Thickness: Thickness required for size of panel based upon manufacturer's written recommendations, but not less than 12 mm.
- B. Glass: Type 1, tempered, 1/2-inch thick, as specified in Section 08 80 00.

2.04 SWINGING DOORS

- A. Accessibility Standard: Comply with applicable provisions in ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 requirements of authorities having jurisdiction.
- B. Single Door: Glass panel matching partition panel material and thickness.

2.05 MATERIALS

- A. Aluminum: ASTM B221, with strength and durability characteristics of not less than Alloy 6063-T5.
- B. Stainless Steel: ASTM A666, Type 304.

2.06 FINISHES

- A. Stainless Steel: No. 4 directional satin finish.

2.07 DOOR HARDWARE AND FITTINGS

- A. Door Hardware, General: All-glass door hardware units in types, sizes, quantities, and mounting locations recommended by manufacturer for glass door types, sizes, and operation. For exposed components, match metal and finish of exposed partition fittings unless otherwise noted.
- B. Locking Ladder Pull: Pair of tubular lockable pull handles with thumb turns, Grade 316L stainless steel, accommodating key cylinder, with floor-recessed deadbolt.
 - 1. Basis of Design: DORMAKABA, TG 138 Locking Ladder Pulls.
 - 2. Unit Length: 60 inch (1524 mm).
 - 3. Basis of Design: DORMAKABA, PURE Pivot Header.
- C. Concealed Overhead Closers and Bottom Pivots: Center hung; BHMA A156.4, Grade 1. Provide housings, bottom arms, top walking beam pivots, mounting plates, and accessories.
 - 1. Basis of Design: DORMAKABA, RTS88BFI.
 - 2. Swing: Single acting.
 - 3. Opening Force: Comply with interior door operating force of authorities having jurisdiction for accessibility requirements and egress doors.
- D. Exit Devices: BHMA A156.3 and UL 305.
 - 1. Basis of Design: DORMAKABA, DG1000.
 - 2. Function: Operation by push-pull when inside operator is locked down (dogged).
 - 3. Latching: Fixed strike, located at door head.
 - 4. Pull: One side; design as selected by Architect from manufacturer's standard designs.
- E. Accessory Fittings: Overhead doorstop.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine partition substrates to determine if work is within glass panel partition manufacturer's required tolerances and ready to receive work. Proceed with installation of partitions once conditions affecting installation and performance of partitions meet manufacturer's requirements.
- B. Verify that partition construction adjacent to acoustically-rated glass panel partitions complies with requirements of ASTM E557.

3.02 PARTITION INSTALLATION

- A. General: Comply with glass panel partition manufacturer's written installation instructions and approved shop drawings.
- B. Install glass panel partitions after other finishing operations have been completed.
- C. Set units level, plumb, and true to line, with uniform joints.

- D. Fasten glass panel partition track and sill to building structure and supports as indicated on approved shop drawings, utilizing approved fasteners and spacing.
- E. Set, seal, and grout floor closer cases.

3.03 ADJUSTING

- A. Adjust doors and hardware to produce smooth operation and tight, uniform fit.
- B. Adjust door closers to required timing and force.
- C. Adjust latches and locks for smooth operation.
- D. Replace damaged panels and accessories.

3.04 CLEANING

- A. Clean glass panels in accordance with glass manufacturer's written instructions. Do not use cleaning agents or methods not approved by glass manufacturer.
- B. Clean exposed metal surfaces to factory new appearance.

END OF SECTION

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SECTION 08 71 00**DOOR HARDWARE****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. This Section includes the following, but is not necessarily limited to:
 - 1. Door Hardware, including electric hardware.
 - 2. Storefront and Entrance door hardware.
 - 3. Digital keypad access control devices.
 - 4. Power supplies for electric hardware.
 - 5. Thresholds, gasketing and weather-stripping.
 - 6. Door silencers or mutes.
- C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.
 - 1. Section 08 11 16 - Aluminum Doors and Frames.
 - 2. Section 08 14 16 - Flush Wood Doors.
 - 3. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
 - 4. Section 08 41 26 - All-Glass Entrances – Alternates #2 and #4

1.03 REFERENCES (USE DATE OF STANDARD IN EFFECT AS OF BID DATE.)

- A. 2022 California Building Code, CCR, Title 24.
- B. BHMA – Builders' Hardware Manufacturers Association
- C. CCR – California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.
- D. DHI – Door and Hardware Institute
- E. NFPA - National Fire Protection Association.
 - 1. NFPA 80 - Fire Doors and Other Opening Protectives
 - 2. NFPA 105 - Smoke and Draft Control Door Assemblies
- F. UL - Underwriters Laboratories.
 - 1. UL 10C - Fire Tests of Door Assemblies
 - 2. UL 305 - Panic Hardware

G. WHI - Warnock Hersey Incorporated

H. SDI - Steel Door Institute

1.04 SUBMITTALS & SUBSTITUTIONS

- A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.
- B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- C. Submit schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
1. Include a Cover Sheet with;
 - a. Job Name, location, telephone number.
 - b. Architects name, location and telephone number.
 - c. Contractors name, location, telephone number and job number.
 - d. Suppliers name, location, telephone number and job number.
 - e. Hardware consultant's name, location and telephone number.
 2. Job Index information included;
 - a. Numerical door number index including; door number, hardware heading number and page number.
 - b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
 - c. Manufacturers' names and abbreviations for all materials.
 - d. Explanation of abbreviations, symbols, and codes used in the schedule.
 - e. Mounting locations for hardware.
 - f. Clarification statements or questions.
 - g. Catalog cuts and manufacturer's technical data and instructions.
 3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number – HW -1)					
			(a) 1 Single Door #1 - Exterior from Corridor 101	(b) 90°	(c) RH
			(d) 3' 0"x7' 0" x 1-3/4" x (e) 20 Minute (f) WD x HM		
(g) 1	(h)	(i) ea	(j) Hinges - (k) 5BB1HW 4.5 x 4.5 NRP (l) ½ TMS	(m) 626	(n) IVE
2	6AA	1 ea	Lockset - ND50PD x RHO x RH x 10-025 x JTMS	626	SCH

(a) - Single or pair with opening number and location. (b) - Degree of opening (c) - Hand of door(s) (d) - Door and frame dimensions and door thickness. (e) - Label requirements if any. (f) - Door by frame material. (g) - (Optional) Hardware item line #. (h) - Keyset Symbol. (i) - Quantity. (j) - Product description. (k) - Product Number. (l) - Fastenings and other pertinent information. (m) - Hardware finish codes per ANSI A156.18. (n) - Manufacture abbreviation.

- D. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.
- E. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.
- F. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- G. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- H. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.
- I. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the Owner to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.
- J. LEED Certification Points: Submit information and certifications necessary to achieve maximum points for LEED certification; coordinate and cooperate with Owner and Architect in providing information necessary for required LEED rating.

1.05 QUALITY ASSURANCE

- A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
 - 1. Responsible for detailing, scheduling and ordering of finish hardware.
 - 2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing.
 - 3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.
- D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.

1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".
- E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.
- B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.
- C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.
- D. Contractor to inventory door hardware jointly with representatives of hardware supplier and hardware installer until each all are satisfied that count is correct.
- E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- F. Product packaging to be labelled in compliance with CA Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986.

1.07 WARRANTY

- A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
 1. Locksets: "L", "ND" Ten (10) years.
 2. Electric Strikes: Five (5) years.
 3. Power Supplies: Three (3) years.
 4. Closers: 4000 Thirty (30) years– except electronic and fire life safety closers and holders shall be Two (2) years.
 5. Exit devices: 33/35A Ten (10) years – Electronic Three (3) years.
 6. Overhead Stops: Ten (10) Years.
 7. Seals: Five (5) years – Finish One (1) Year.
 8. All other hardware: Two (2) years.

1.08 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.09 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference at least one week prior to beginning work of this section.

- B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key District Personnel, and Project Inspector.
- C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review District's keying standards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitutes</u>
Hinges	Ives	Hager, Stanley, McKinney
Locks, Latches & Cylinders	Schlage	Or Approved Equal
Exit Devices	Von Duprin	Or Approved Equal
Closers	LCN	Or Approved Equal
Push, Pulls & Protection Plates	Ives	Trimco, BBW, DCI
Flush Bolts	Ives	Trimco, BBW, DCI
Dust Proof Strikes	Ives	Trimco, BBW, DCI
Coordinators	Ives	Trimco, BBW, DCI
Stops	Ives	Trimco, BBW, DCI
Overhead Stops	Glynn-Johnson	Or Approved Equal
Thresholds	Zero	Pemko, National Guard
Seals & Bottoms	Zero	Pemko, National Guard

2.02 MATERIALS

- A. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
1. Hinges shall be sized in accordance with the following:
 - a. Height:
 - 1) Doors up to 36" wide: 4-1/2" inches.
 - 2) Doors 36" to 48" wide: 5 inches.
 - b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
 - c. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
 2. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.
- B. Continuous Hinges: As manufactured by Ives, an Allegion Company. UL rated as required.

- C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" design, fastened with through-bolts and threaded chassis hubs.
1. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
 - a. Abusive Locked Lever Torque Test – minimum 3,100 inch-pounds without gaining access
 - b. Offset lever pull – minimum 1,600 foot pounds without gaining access
 - c. Vertical lever impact – minimum 100 impacts without gaining access
 2. Cycle life - tested to minimum 16 million cycles per ANSI/BHMA A156.2 Cycle Test with no visible lever sag or use of performance aids such as set screws or spacers
 3. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
 4. Cylinders: Refer to "KEYING" article, herein.
 5. Provide solid steel anti-rotation through bolts and posts to control excessive rotation of lever.
 6. Provide lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.
 7. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw capable of UL listing of 3 hours on a 4' x 10' opening. Provide proper latch throw for UL listing at pairs.
 8. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 9. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 10. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 11. Provide wired electrified options as scheduled in the hardware sets.
 - a. 12 through 24 volt DC operating capability, auto-detecting
 - b. Selectable EL (fail safe)/EU (fail secure) operating mode via switch on chassis
 - c. 0.230A (230mA) maximum current draw
 - d. 0.010A (10mA) holding current
 - e. Modular / "plug in" request to exit switch
 12. Lever Trim: Solid cast levers without plastic inserts, and wrought roses on both sides.
- D. Schlage "L" Series as scheduled with "06" Style Lever and "A" Style Rose.
1. Locksets to comply with ANSI A156.13, Series 1000, Operational Grade 1 and Security Grade 1 with all standard trims. Locksets shall also comply with UL10C Positive Pressure requirements
 2. Lock case shall be manufactured with heavy 12 gauge steel with fully wrapped design. Lock cases with exposed edges are not acceptable. Lock case shall be multi-functional allowing transformation to a different function without opening lock case.
 3. Latchbolt shall have 3/4" throw and be non-handed, field reversible without opening the lock case. Solid latchbolts and / or plastic anti-friction devices are not acceptable.
 4. The deadbolt, when used, shall be 1" throw stainless steel with a 3/4" internal engagement when fully extended.
 5. All trim shall be through-bolted with the spring cages supporting the trim attached to the lock cases to prevent torqueing.
 6. Levers to have independent rotation in both directions. Exterior lever assembly to be one-piece design attached by threaded bushing. Interior lever assembly shall be attached by screwless shank
 7. Thru-bolt lever assemblies through the door for positive interlock. Locks using a through the door spindle for attachment are not acceptable. Spindles shall be independent, designed to "break-away" at a maximum of 75psi torque.
 8. Hand of lock chassis to be changeable by simply moving one screw from one side to the case to the other and pulling and reversing the latchbolt.

9. Cylinders to be secured by a cast stainless steel, dual retainer. Locks utilizing screws and / or stamped retainers are not acceptable.
- E. Exit devices: Von Duprin as scheduled.
1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
 2. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
 3. Mechanism case shall have an average thickness of .140".
 4. Compression spring engineering.
 5. Non-handed basic device design with center case interchangeable with all functions.
 6. All devices shall have quiet return fluid dampeners.
 7. All latchbolts shall be deadlocking with $\frac{3}{4}$ " throw and have a self-lubricating coating to reduce friction and wear.
 8. Device shall bear UL label for fire and or panic as may be required.
 9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
 10. Lever Trim: "Breakaway" design, forged brass or bronze escutcheon with a minimum of .130" thickness, match lockset lever design.
 11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
 12. Furnish glass bead kits for vision lites where required.
 13. All Exit Devices to be sex-bolted to the doors.
 14. Panic Hardware shall comply with CBC Section 11B.404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
 - a. Provide exit devices UL certified to meet maximum 5 pound requirements according to the California Building Code section 11B-309.4, and UL listed for Panic Exterior Fire Exit Hardware maximum opening force of 15 pounds according to the California Building Code section 11B-404.2.9.
- F. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.
1. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
 2. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
 3. All parallel arm closers shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16" steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
 4. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
 5. Closers shall be installed to permit doors to swing 180 degrees.
 6. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.
 7. Provide the manufactures drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed.

8. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. 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. Per 11B-404.2.8.1, door shall take at least 5 seconds to move from an open position of 90 degrees to a position of 12 degrees from the latch jamb.
- G. Flush Bolts & Dust Proof Strikes: Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.
1. Manual flush bolts only permitted on storage or mechanical openings as scheduled.
 2. Provide dust proof strikes at openings using bottom bolts.
- H. Door Stops:
1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
 2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
 3. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- I. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.
- J. Thresholds: As Scheduled and per details.
1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
 2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 "Thermal and Moisture Protection".
 3. Use 1/4" fasteners, red-head flat-head sleeve anchors (SS/FHSL).
 4. Thresholds shall comply with CBC Section 11B-404.2.5.
- K. Seals: Provide silicone gasket at all rated and exterior doors.
1. Fire-rated Doors, Resilient Seals: UL10C Classified complies with NFPA 80 & NFPA 252. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
 2. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C Classified complies with NFPA 80 & NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required.
 3. Smoke & Draft Control Doors, Provide UL10C Classified complies with NFPA 80 & NFPA 252 for use on "S" labeled Positive Pressure door assemblies.
- L. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.

- M. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.03 KEYING

- A. Furnish all cylinders in the Schlage conventional style except the exit device and removable mullion cylinders which will be supplied in Schlage Full Size Interchangeable Core (FSIC). Pack change keys independently (PKI).
- B. Furnish construction keying for doors requiring locking during construction.
1. For "Split Key" Construction Cylinders (non-IC cylinders) specify "CK" for each keyed cylinder.
 2. Provide ten Construction Keys (48-104 "Classic", 48-008 "Everest")
 3. Provide two Extractor Tools (35-057)
- C. Furnish all keys with visual key control.
1. Stamp key "Do Not Duplicate".
 2. Stamp (BHMA) key symbol on key.
- D. Furnish all cylinders with visual key control.
1. Stamp (BHMA) key symbol on side of cylinder (CKC).
- E. Furnish mechanical keys as follows:
1. Furnish 2 cut change keys for each different change key code.
 2. Furnish 1 uncut key blank for each change key code.
 3. Furnish 6 cut masterkeys for each different masterkey set.
 4. Furnish 3 uncut key blanks for each masterkey set.
 5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
 6. Furnish 1 cut control key cut to each SKD combination.
- F. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.
1. Furnish KS43D2200 padlock for use with non-I/C Schlage cylinders. Furnish 47-413 (conventional) or 47-743-XP (PrimusXP) with above.
 2. Furnish KS43G3200 padlock for use with FSIC Schlage cylinders. Furnish 23-030 (Classic / Everest) or 20-740 (PrimusXP) with above.
 3. Furnish KS41D1200 padlock for use with SFIC Schlage cylinders. Furnish 80-037 (Everest-B) with above.
- G. Furnish one Schlage cabinet lock for each cabinet door or drawer so designated on the drawings or keying schedule to match the masterkey system.
1. Furnish CL100PB for use with non-I/C Schlage cylinders.
 2. Furnish CL77R for use with FSIC Schlage cylinders.
 3. Furnish CL721G for use with SFIC Schlage cylinders.

2.04 FINISHES

- A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
- B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.
- C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.
- D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.05 FASTENERS

- A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
- B. Screws for butt hinges shall be flathead, countersunk, full-thread type.
- C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
- D. Provide expansion anchors for attaching hardware items to concrete or masonry.
- E. All exposed fasteners shall have a phillips head.
- F. Finish of exposed screws to match surface finish of hardware or other adjacent work.
- G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION**3.01 INSPECTION**

- A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
- B. Use the templates provided by hardware item manufacturer.
- C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 34" and 44" AFF.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

- F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.
- G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.
- H. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.
- I. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.
- J. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for in the Electrical Section.
- K. Conductors shall be minimum 18 gage stranded, multicolored. A minimum 12 in. loop of conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.
- L. If a power supply is specified in the hardware sets, all conductors shall be terminated in the power supply. Make all connections required for proper operation between the power supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacturer's technical documentation.

3.03 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surface soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. 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.

3.04 HARDWARE LOCATIONS

- A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.05 FIELD QUALITY CONTROL

- A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.06 SCHEDULE

- A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.
- B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.
- C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

Manufacturers Abbreviations (Mfr.)

IVE	=	Ives	Hinges, Protection Plates, Door Stops &
		Silencers	
JOH	=	L.E. Johnson	Sliding Door Hardware
LCN	=	LCN	Door Closers
SCE	=	Schlage Electronics	Electronic Door Components
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders
TRI	=	Trimco	Signs
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Thresholds, Gasketing & Weather-stripping

HARDWARE GROUP NO. 01

For use on Door #(s):

101 212

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CD-PA-AX-35A-NL-OP-388	626	VON
1	EA	RIM CYLINDER	20-057	626	SCH
1	EA	MORTISE CYLINDER	26-091 XQ11-948	626	SCH
1	EA	LONG DOOR PULL	9264 72" 56" O	630-316	IVE
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	AL	ZER
1		WEATHERSTRIP BY DOOR/FRAME MANUFACTURER			

PROVIDE DOOR SIGN FOR OPENING 212 "THESE DOORS TO REMAIN UNLOCKED DURING BUSINESS HOURS"

HARDWARE GROUP NO. 02

For use on Door #(s):

201

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
1	EA	EXIT DEVICE	DB-100-L-S	630	CRL
1	EA	MORTISE CYLINDER	26-091	626	SCH
1	EA	MORTISE CYLINDER	30-001	626	SCH
1	EA	CONC. AUTO OPERATOR	2811 STD/OP MS120V / 240V AC	ANCLR	LCN
2	EA	ACTUATOR, TOUCH	8310-836T	630	LCN
1	EA	POWER SUPPLY	SOLAK		LCN
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER DETAIL	AL	ZER
1	EA	KEY SWITCH	653-04	626	SCE
1			POWER SUPPLY - WORK OF DIVISION 28		
1			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

HARDWARE GROUP NO. 03

For use on Door #(s):

202 203

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE W/SIM RETRACT W/ OUTSIDE INDICATOR	L9056P 06A L583-363 OS-OCC	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	SEAL SET	BY FRAME MANUFACTURER		

HARDWARE GROUP NO. 04

For use on Door #(s):

206

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD RHO	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

HARDWARE GROUP NO. 05

For use on Door #(s):

209

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80PD RHO	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE GROUP NO. 06

For use on Door #(s):

207

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80PD RHO	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE

HARDWARE GROUP NO. 07

For use on Door #(s):

210 211

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PIVOT SET	7215 SET	626	IVE
1	EA	PATCH FITTINGS	BY DOOR MANUFACTURER		
1	EA	LONG DOOR PULL	PR 9266 72" 56" P	630-316	IVE
1	EA	FLOOR STOP	FS436	626	IVE

HARDWARE GROUP NO. 08

For use on Door #(s):

102A 112

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1			EXISTING DOOR, FRAME AND HARDWARE TO REMAIN		

END OF SECTION

SECTION 08 80 00**GLAZING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Glass and glazing.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 08 11 16 - Aluminum Doors and Frames: Provision of aluminum doors and frames.
 - 2. Section 08 14 16 - Flush Wood Doors: Provision of flush wood doors.
 - 3. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts: Provision of aluminum-framed entrances and storefronts.
 - 4. Section 08 41 26 - All-Glass Entrances: Provision of interior frameless glass wall.

1.02 REFERENCES

- A. ANSI - American National Standards Institute
 - 1. Z97.1 - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- B. ASTM - American Society for Testing and Materials
 - 1. C1036 - Standard Specification for Flat Glass.
 - 2. C1048 - Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
 - 3. E1300 - Practice for Determining the Minimum Thickness of Annealed Glass Required to Resist a Specified Load.
 - 4. E2010 - Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.
 - 5. E2074 - Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
- C. CBC - California Building Code, 2022 Edition
- D. CPSC - Consumer Products Safety Commission
 - 1. 16 CFR Part 1201 - Safety Standard for Architectural Glazing Materials.
- E. GANA - Glass Association of North America
- F. UL - Underwriters Laboratories Inc.
 - 1. 752 - Standard for Bullet-Resisting Equipment.

1.03 SYSTEM DESCRIPTION

- A. Glass Design Requirements: Glass thicknesses indicated on the Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths to meet or exceed the following criteria:
 - 1. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the

following: 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E1300 based on type of glass.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each glass product and glazing material indicated.
- B. Samples: Submit samples for verification purposes of 12 inch square samples of each type of glass indicated except for clear monolithic glass products, and 12 inch long samples of each color required for each type of sealant or gasket exposed to view. Install sealant or gasket sample between 2 strips of material representative in color of the adjoining framing system.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements
 - 1. Glass and glazing shall meet requirements of CBC.
 - 2. Safety Requirements: Provide glass and glazing complying with ANSI Z97.1, CBC, and testing requirements of CPSC 16 CFR Part 1201 for Category II materials.
 - 3. Fire Resistive Glazing Products: Products identical to those tested in accordance with ASTM E2074 for doors and ASTM E2010 for window assemblies; both labeled and listed by UL.
- B. Single-Source Responsibility for Glass: Obtain glass from 1 source for each product indicated below:
 - 1. Primary glass of each type and class indicated; ASTM C1036.
 - 2. Heat-treated glass of each condition indicated; ASTM C1048.
 - 3. Insulating glass of each construction indicated.
- C. Glazing Publications: Comply with published recommendations of "GANA Glazing Manual", except where more stringent requirements are indicated. Refer to this publication for glazing terms not otherwise defined in this Section or in referenced standards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Vitro Architectural Glass; Guardian SunGuard; Cardinal Industries, or approved equal.

2.02 MATERIALS

- A. Glass Type 1 - Interior Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 1/2-inch thick, unless otherwise noted.
 - 1. Refer to Section 08 41 26.
- B. Glass Type 2 - Interior Tempered and Frosted Glass: ASTM C1048, Kind FT (fully tempered), Type I (transparent glass, flat), Appearance (frosted), Quality q3 (glazing select), 1/2-inch thick, unless otherwise noted.

- C. Glass Type 3 - Exterior Sealed Insulating Glass Unit
 - 1. Preassembled unit composed of the following:
 - a. Outboard Lite: Low-E float glass, ASTM C1048, Kind FT (fully tempered), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 1/4-inch thick, unless otherwise noted.
 - b. Air Space: 1/2-inch.
 - c. Inboard Lite: Float glass, ASTM C1048, Kind FT (fully tempered), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 1/4-inch thick, unless otherwise noted.
 - 2. Product: As manufactured by Vitro Architectural Glass, "Solarban 70 Solar Control Low-E Glass", or approved equal.
- D. Glazing Accessories
 - 1. Setting Blocks, Spacers and Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.
 - 2. Sealant: One part non-acid curing silicone type, as manufactured by Dow Corning Corp., "795"; General Electric Corp., "Silpruf"; Tremco, Inc., "Spectrum 2", or approved equal.
 - 3. Glazing Tape: Provide manufacturer's standard solvent free butyl-polyisobutylene formulation with solids content of 100 percent; in extruded tape form; non-staining and non-migrating in contact with nonporous surfaces; packaged on rolls with release paper on 1 side; with or without continuous spacer rod as recommended by manufacturers of tape and glass for application indicated.
 - 4. Film at Lower Level Storefront: Translucent, as selected by the Architect and as manufactured by 3M, or approved equal.

2.03 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for the Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.01 GLAZING, GENERAL

- A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions shall provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass from edge damage during handling and installation as follows:
 - 1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
 - 2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
 - 1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and 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.
- H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.02 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 in one continuous length. Do not stretch tapes to make them fit opening.
- C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these 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 just before each lite is installed.
- F. Apply heel bead of elastomeric sealant.
- G. 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.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.03 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

- B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- C. Install gaskets so they protrude past face of glazing stops.

3.04 PROTECTION AND CLEANING

- A. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

END OF SECTION

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SECTION 08 90 00**LOUVERS AND VENTS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Fixed, extruded-aluminum louvers.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 07 65 00 - Flexible flashing: Provision of flexible flashing.

1.02 REFERENCES

- A. AAMA - American Architectural Manufacturers Association
 - 1. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. AMCA - Air Movement and Control Association
 - 1. 500 - Test Methods for Louvers, Dampers.
- C. ASTM - American Society for Testing and Materials
 - 1. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. B221 - Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements: Design louvers, including comprehensive engineering analysis by a qualified engineer, using structural performance requirements and design criteria indicated.
- B. Performance Requirements
 - 1. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.
 - 2. Wind Loads: Determine loads based on a uniform pressure of 30 lb./sq. ft., acting inward or outward.
 - 3. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

- C. Samples: For each type of metal finish required.
- D. Submittal: For louvers indicated to comply with structural performance requirements and design criteria indicated.
- E. Product Test Reports: Based on tests performed according to AMCA 500-L.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Architectural Louvers Co. (Harray, LLC), "Model E6JN", or approved equal.

2.02 MATERIALS

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5.
- B. Aluminum Sheet: ASTM B209, Alloy 3003 with temper as required for forming.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
- D. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

2.03 FABRICATION, GENERAL

- A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.04 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal High Performance Narrow Profile Non-drainable Blade Louver
 - 1. Louver Depth: 6 inches.
 - 2. Blade Profile: Narrow plain blade without center baffle.
 - 3. Frame and Blade Nominal Thickness: Not less than 0.080-inch.
 - 4. Louver Performance Ratings
 - a. Free Area: Not less than 11.25 sq. ft. for 48-inch wide by 48-inch high louver.
 - b. Point of Beginning Water Penetration: Not less than 815 fpm.
 - c. Air Performance: Not more than 0.12-inch wg static pressure drop at 815 fpm free-area velocity.

2.05 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
- B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.

- C. Louver Screening: Same kind of metal as indicated for louver.
 - 1. Insect Screening: Aluminum, 16 x 18 square mesh, 0.011-inch wire.
 - 2. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050-inch thick.

2.06 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by the Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.
- E. Protect galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint.

END OF SECTION

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SECTION 09 29 00**GYPSUM BOARD****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Gypsum board screw attached to wood framing and furring members, joint treatment, and accessories.
 - 2. Installation of sound deadening insulation in walls and ceilings and including acoustical sealant, tape, and the like for work of this Section.
 - 3. Gypsum sheathing.
 - 4. Finishes, GWB-1 and GWB-2.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 05 45 00 - Metal Support Assemblies: Provision of metal support assemblies.
 - 2. Section 06 64 00 - Plastic Paneling: Provision of FRP panels.
 - 3. Section 07 21 01 - Building Insulation: Provision of building insulation.
 - 4. Section 07 40 00 - Roofing and Siding Panels: Provision of metal panels at exterior.
 - 5. Section 07 92 00 - Joint Sealants: Provision of caulking and sealants.
 - 6. Section 08 31 13 - Access Doors and Frames: Provision of access doors and frames.
 - 7. Section 09 30 00 - Tiling: Provision of ceramic tile.
 - 8. Section 09 72 00 - Wall Coverings: Provision of vinyl-coated fabric wall graphics.
 - 9. Section 09 90 00 - Painting and Coating: For finish painting.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 2. C514 - Standard Specification for Nails for the Application of Gypsum Board.
 - 3. C840 - Standard Specification for Application and Finishing of Gypsum Board.
 - 4. C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - 5. C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - 6. C1396 - Standard Specification for Gypsum Board.
 - 7. D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 8. E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- B. CBC - California Building Code, 2022 Edition
- C. CFR - Code of Federal Regulations
 - 1. 40 CFR 59 - National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.

- D. EPA - Environmental Protection Agency
 - 1. Method 24 - Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings.
- E. GA - Gypsum Association
 - 1. 201 - Using Gypsum Board for Walls and Ceilings.
 - 2. 214 - Recommended Levels of Gypsum Board Finish.
 - 3. 216 - Application and Finishing of Gypsum Panel Products.
 - 4. 253 - Application of Gypsum Sheathing.
 - 5. 600 - Fire Resistance Design Manual.
- F. UL - Underwriters Laboratories Inc.
 - 1. FRD - Fire Resistance Directory.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data. Include the following
 - 1. Fire Resistance Data: Include required fire test results for gypsum board systems on partitions and ceilings.
 - 2. Sound Transmission Data: Include certified evidence that installed gypsum board systems and materials meet required STC levels.

1.04 QUALITY ASSURANCE

- A. Fire Test Response Characteristics: Where fire resistance rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:
 - 1. Fire Resistance Ratings: As indicated by GA File Numbers in GA 600 or design designations in UL FRD or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: United States Gypsum Co.; Gold Bond Building Products Div., National Gypsum Co.; Pacific Coast Building Products, Pabco Gypsum Division, or approved equal.

2.02 MATERIALS

- A. Gypsum Board Types
 - 1. Type 1: Fire rated board for fire resistance rated assemblies, ASTM C1396, Type X, tapered edges, 48 inches wide, 5/8-inch thick.
 - 2. Type 2: Fire rated water resistant board, ASTM C1396, Type X, tapered edges, 48 inches wide, 5/8-inch thick.
 - 3. Type 3: Water-resistant treated core covered front and back with fiberglass mats, meets ASTM D3273 for mold-resistance, thickness as indicated, as manufactured by Georgia Pacific, "DensShield Tile Backer", or approved equal.

- B. Exterior Sheathing
 - 1. Typical: Silicone treated gypsum core, surfaced with inorganic glass mats and gold color alkali resistant surface coating, 5/8-inch thick, as manufactured by Georgia Pacific, "DensGlass Gold"; United State Gypsum Co., or approved equal.
 - 2. Fire Resistance Rated: Silicone treated gypsum core, surfaced with inorganic glass mats and gold color alkali resistant surface coating, Type X, 5/8-inch thick, as manufactured by Georgia-Pacific Corp., "DensGlass Gold Fireguard"; United States Gypsum Co., or approved equal.
- C. Screws: ASTM C1002, machine thread for gypsum board to metal attachments.
- D. Nails: ASTM C514, wood thread for metal or gypsum board attachment to wood.
- E. Insulation: As specified in Section 07 21 01.
- F. Adhesives: 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).
- G. Accessories
 - 1. Corner Beads and Casing Beads: ASTM C1047, sheet steel zinc coated by hot-dip process. Use bullnose corner beads at typical wall and ceiling outside corners. Use square corner beads at windows.
 - 2. Resilient Channels: As manufactured by Unimast, "RC Deluxe"; Cemco, "RC-1"; Dale/Incor, "RFC-1", or approved equal.
 - 3. Hat Channels: Hat-shaped, corrosion-resistant rigid furring channels, ASTM C645, 7/8-inch deep unless otherwise indicated, base metal thickness as required, as manufactured by Dietrich Metal Framing, Inc., "FC-Series"; Fry Reglet Corporation, or approved equal.
 - 4. "F" Molding: Extruded aluminum, alloy 6063 T5, depth as indicated, chemical conversion coating, clear anodized, as manufactured by Fry Reglet Corporation, "Fry Reglet F Reveal"; Dietrich Metal Framing, Inc., or approved equal.
 - 5. "J" Molding: Extruded aluminum, alloy 6063 T5, depth as indicated, chemical conversion coating, clear anodized, as manufactured by Fry Reglet Corporation, "Fry Reglet "J" Molding"; Dietrich Metal Framing, Inc., or approved equal.
 - 6. "Z" Molding: Extruded aluminum, alloy 6063 T5, depth and width as indicated, chemical conversion coating, clear anodized, as manufactured by Fry Reglet Corporation, "Fry Reglet "Z" Molding", or approved equal.
 - 7. Picture Rail: Molding reveal track for hanging pictures; clear anodized 6063 aluminum; 1-3/4 inches track width; 3.4 inches overall width by 10 feet/piece.
 - a. Product: As manufactured by Fry Reglet, "DRMH-50", or approved equal.
- H. Joint Treatment Materials: Products of one manufacturer conforming to ASTM C475, ASTM C840, and recommendations of manufacturer of both gypsum board and joint treatment materials for application indicated. Conform to GA 201 and GA 216 for reinforcing tape, joint compound, and water.
 - 1. Joint Tape
 - a. Cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape as recommended by setting type joint compound manufacturer.
 - b. For silicone treated gypsum backer board, use 2 inch wide, 10-inch by 10-inch woven glass mesh tape.
 - 2. Setting Type Joint Compound: Factory prepackaged, job mixed, chemical hardening powder products formulated for uses indicated or factory premixed product. Use hot type at exterior gypsum soffits.
- I. Acoustical Sealant: As specified in Section 07 92 00.

2.03 FINISHES

- A. Levels of Gypsum Board Finish as Defined by GA 214. Levels are only examples and do not constitute a schedule of finish. See Drawings for levels of finish.
1. Levels 0 - 3: Not applicable.
 2. Level 4: All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of final finishes.
 - a. GWB-2: Level 4 finish, painted.
 3. Level 5: All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of finish paint.
 - a. GWB-1: Level 5 finish, painted.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Gypsum Board
1. Install and finish gypsum board to comply with ASTM C840 or GA 216.
 - a. Single Layer: Install in accordance with ASTM C840, except as amended or required by specific fire resistive or sound isolation system detailed. In that instance, application shall conform to requirements of the manufacturer's tests as reviewed and accepted in the submittal.
 - b. Double Layer: Conform to applicable portions of ASTM C840, System Classification VIII for installations applied with screws. Conform to required fire resistance standards.
 2. Apply in horizontal direction with ends and edges falling on supports. Gypsum board shall be of maximum length possible to reach full wall or ceiling lengths with minimal number of joints.
 3. Position boards so that like edges abut, tapered edges against tapered edges and field cut ends against field cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
 4. Start installation of panels at exterior wall to position butt joints as far away from exterior wall as possible.
- B. Fire Resistant Assemblies: Wherever fire rated gypsum board construction is indicated, provide materials and installation methods, including types and spacing of fasteners, in accordance with CBC, GA Manual, or listed assembly indicated. Apply firestopping at top of wall and at penetrations through fire resistant assembly.
- C. Sound Retardant Installations: Follow manufacturer's directions and specifications for conditions of installation. Install where indicated in conformance with current Project acoustic report. Install from floor surface to bottom side of next floor surface.

1. Wrap with insulation and Lowry Pads and seal electrical or other outlets in sound isolating partitions and ceilings. Fill all partitions completely with batt insulation.
 2. Install sealant to completely fill void between gypsum board edges and adjacent surface.
- D. Gypsum Sheathing
1. Comply with GA 253 and manufacturer's written instructions.
 2. Cut boards at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
 3. Install boards with a 3/8-inch setback where non-load-bearing construction abuts structural elements.
 4. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
 5. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
 6. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
 7. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of stud flanges, and stagger end joints of adjacent boards not less than one stud spacing. Screw-attach boards at perimeter and within field of board to each steel stud.
 - a. Space fasteners approximately 8 inches on center and set back a minimum of 3/8-inch from edges and ends of boards.
 8. Vertical Installation: Install board vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud.
 - a. Space fasteners approximately 8 inches on center and set back a minimum of 3/8-inch from edges and ends of boards.
- E. Wet Locations
1. At Walls and Ceilings: Conform to ASTM C840, System Classification X.
 2. Treat cut edges and holes in water resistant gypsum board with sealant.
- F. Fastenings: Attach gypsum board to framing with screws, lengths and sizes as recommended by manufacturer and in accordance with CBC.
- G. Accessories
1. Install corner beads at vertical and horizontal external corners; tape inside corners.
 2. Install casing beads whenever edge of gypsum board would otherwise be exposed or semi-exposed, or where abutting dissimilar materials.
 3. After accessories are installed, correct surface damage and defects.
 4. Install trims and expansion joints where required.
 5. Resilient Channel Attachment: Screw attach resilient channel through foot on 1 side of channel only to wood joists. Screw attach gypsum board through channel face only. At resilient channel assemblies, screw attached gypsum board shall not be in contact with joists, studs, or any rigid fastening.
- H. Allowable Tolerances
1. Offset Between Planes of Board Faces: 1/16-inch.
 2. Plane, Level, Warp and Bow: 1/8-inch in 8 feet.
 3. Shim panels as necessary to comply with tolerances.

3.02 FINISHING OF GYPSUM BOARD

- A. Apply joint treatment at gypsum board joints; flanges of corner bead, edge trim and penetrations, fastener heads and surface defects in accordance with ASTM C840 or GA 216. Number of coats of treatment shall be as specified above.
- B. Finish Painting: As specified in Section 09 90 00.

END OF SECTION

SECTION 09 30 00**TILING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Interior ceramic floor tile, CT-1.
 - 2. Interior ceramic wall tile, CT-2.
 - 3. Interior ceramic accent tile, CT-3.
 - 4. Waterproof membrane, bond coats, installation beds, grout materials, and accessories.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 03 54 16 - Hydraulic Cement Underlayment: Provision of underlayment at flooring installations.
 - 2. Section 07 92 00 - Joint Sealants: For sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 3. Section 09 29 00 - Gypsum Board: Provision of tile backer board.
 - 4. Section 09 68 13 - Tile Carpeting: Provision of transition flooring strip.

1.02 REFERENCES

- A. ANSI - American National Standards Institute
 - 1. A108.1 - Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
 - 2. A108.5 - Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
 - 3. A108.6 - Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy.
 - 4. A108.10 - Installation of Grout in Tilework.
 - 5. A118.1 - Dry-Set Portland Cement Mortar.
 - 6. A118.4 - Latex-Portland Cement Mortar.
 - 7. A118.6 - Ceramic Tile Grouts.
 - 8. A118.10 - Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installations.
 - 9. A136.1 - Organic Adhesives for Installation of Ceramic Tile.
 - 10. A137.1 - Ceramic Tile.
- B. ASTM - American Society for Testing and Materials
 - 1. A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - 3. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 4. F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- C. TCNA - Tile Council of North America
 - 1. Handbook for Ceramic Tile Installation.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each type of product specified.
- B. Shop Drawings: Submit shop drawings indicating tile patterns and locations and widths of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
 - 1. Locate precisely each joint and crack in tile substrates by measuring, record measurements on shop drawings, and coordinate them with tile joint locations, in consultation with the Architect.
- C. Samples: Submit samples for initial selection purposes in form of manufacturer's color charts consisting of actual tiles or sections of tile showing full range of colors, textures, and patterns available for each type and composition of tile indicated. Include samples of grout and accessories involving color selection.

1.04 MAINTENANCE

- A. Extra Materials: Deliver extra materials to the Owner. Furnish extra materials that match products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
- B. 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.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers
 - 1. Ceramic Tile: Royal Mosa; Crossville, or approved equal.
 - 2. Tile Setting and Grouting Materials: Custom Building Products, or approved equal.

2.02 MATERIALS

- A. General
 - 1. Colors, Textures, and Patterns: As selected by the Architect from manufacturer's full range of standard colors, textures, and patterns for products of type indicated, with minimum 0.6 percent coefficient of friction for floor tile.
 - 2. Tile Grade: Standard Grade, unless otherwise indicated.
 - 3. Provide ceramic tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated.
 - 4. Provide tile installation materials complying with ANSI standards referenced in setting and grouting materials articles below.
 - 5. Trim Shapes: Provide same material, size, color, and texture as field tile.
- B. Interior Ceramic Floor Tile, CT-1
 - 1. Composition: Porcelain tile.
 - 2. Thickness: 0.47-inch.
 - 3. Size: 6 inches by 24 inches.
 - 4. Surface Finish: Smooth, pattern matte.
 - 5. Color: Mid Grey, 206.
 - 6. Product: As manufactured by Royal Mosa, "Terra Tones", or approved equal.

- C. Interior Ceramic Wall Tile, CT-2
 - 1. Thickness: 0.22-inch.
 - 2. Size: 4 inches by 12 inches.
 - 3. Surface Finish: Plain gloss.
 - 4. Color: White, 13000.
 - 5. Product: As manufactured by Royal Mosa, Global Collection", or approved equal.
- D. Interior Ceramic Accent Tile, CT-3
 - 1. Type: 3/4-inch penny round.
 - 2. Composition: Porcelain mosaic.
 - 3. Thickness: 6 mm.
 - 4. Size: .75-inch diameter, nominal.
 - 5. Surface Finish: Matte.
 - 6. Color: White, MTP01.
 - 7. Product: As manufactured by Crossville, "Multiplier", or approved equal.
- E. Uncoupling Waterproofing Membrane: 1/8-inch thick, orange, high-density polyethylene membrane with a grid structure of 1/2-inch by 1/2-inch square cavities, each cut back in a dovetail configuration, and a polypropylene anchoring fleece laminated to its underside; conforms to definition for uncoupling membranes in TCNA Handbook for Ceramic Tile Installation; meets or exceeds ANSI A118.10 requirements for load bearing, bonded, waterproof membranes for thin-set tile installation.
 - 1. Product: As manufactured by Schluter Systems L.P., "Schluter®-DITRA", or approved equal.
- F. Waterproofing Seaming Membrane: Seams and corners materials, 0.004-inch thick, orange polyethylene membrane with polypropylene fleece laminated on both sides.
 - 1. Product: As manufactured by Schluter Systems L.P., "Schluter®-KERDI-BAND", or approved equal.
- G. Setting Materials
 - 1. Portland Cement Mortar: Materials complying with ANSI A108.1 and as follows:
 - a. Reinforcing Wire Fabric: Galvanized welded wire fabric, 2 inches by 2 inches - WO.3 by WO.3, 16 ASW gauge; comply with ASTM A82 and ASTN A185 except for minimum wire size.
 - 2. Dry-Set Portland Cement Mortar: ANSI A118.1.
 - 3. Latex Portland Cement Mortar: ANSI A118.4.
 - 4. Organic Adhesive: ANSI A136.1, Type I.
- H. Grouting Materials
 - 1. Commercial Latex Portland Cement Grout: ANSI A118.6.
 - 2. Colors: As selected by the Architect from manufacturer's full range.
- I. Sealants: As specified in Section 07 92 00.
- J. Flooring Transition Strip: As specified in Section 09 68 13.

2.03 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
 - 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.
 - 3. Concrete shall be allowed to cure for 90 to 120 days and must be properly sealed. Test concrete for vapor emission by the Calcium Chloride Moisture test method in compliance with ASTM F1869. Emission rate shall not exceed 3 lb/24 hr/1000 sq. ft. Treat with vapor emission treatment systems as required.

3.02 PREPARATION

- A. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in 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.
- B. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:
 - 1. Petroleum paraffin wax, applied hot.

3.03 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.
- B. TCNA Installation Guidelines: TCNA "Handbook for Ceramic Tile Installation"; comply with TCNA installation methods indicated.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. 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 that plates, collars, or covers overlap tile.
- E. Jointing Pattern: See the Architectural Drawings for tile layouts. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area, unless otherwise indicated. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.

- F. 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 installation of tiles.
- G. Grout tile to comply with the requirements of the following installation standards:
 - 1. For ceramic tile grouts and latex-portland cement grouts, comply with ANSI A108.10.
 - 2. Seal grout joints at time of completion.

3.04 WATERPROOFING

- A. Install waterproofing in compliance with waterproofing manufacturer's instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.
- B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.05 INTERIOR INSTALLATION

- A. Floor: Installation of Thin-Set Tile over Plywood Substrate: Install tile to comply with ANSI A118.10 requirements for load bearing, bonded, waterproof membranes for thin-set tile. Comply with TCNA and membrane manufacturer's written instructions.
- B. Wall: Installation of Ceramic Tile Over Cementitious Bond Coat Over Coated Glass Mat Water-Resistant Gypsum Backer Board Over Metal or Wood Studs: Install tile to comply with TCNA installation method W245.
 - 1. Tile: ANSI A108.5.
 - 2. Grout: ANSI A108.6 or A108.10.

3.06 CLEANING AND PROTECTION

- A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex portland cement grout residue from tile as soon as possible.
 - 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
 - a. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
 - 3. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
 - 4. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.
 - a. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
 - b. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
 - 5. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

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SECTION 09 51 00**ACOUSTICAL CEILINGS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Suspended ceiling system, ACT-1.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 2. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3. C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 4. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 5. E1264 - Classification for Acoustical Ceiling Products.
- B. CBC - California Building Code, 2022 Edition
- C. UL - Underwriters Laboratories Inc.
 - 1. FRD - Fire Resistance Directory.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements: Architectural reflected ceiling plan drawings shall govern over Mechanical and Electrical drawings.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data completely describing products.
- B. Shop Drawings: Show complete ceiling layouts, methods and details of installation, and information required for related work.
- C. Samples: 1 panel of each type of acoustical material and grid specified.
- D. Quality Control Submittals: Submit manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

- A. Qualifications: Installer shall have completed at least 3 previous projects of similar size and complexity.
- B. Regulatory Requirements: Install fire rated ceiling systems in accordance with CBC and UL FRD listing and requirements of agency having jurisdiction.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver and store packaged products in original containers with seals unbroken and labels intact until time of use.
- B. Storage and Protection
 - 1. Keep materials dry by storing off ground; under watertight covers.
 - 2. Immediately before installation, panels shall be stored for sufficient time to stabilize temperature and humidity conditions ambient during installation and anticipated for occupancy.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements: Do not begin work until residual moisture has dissipated, and comply with the following:
 - 1. Acoustical Ceilings: Maintain uniform temperature of minimum 60 degrees Fahrenheit and maximum of 90 degrees Fahrenheit and humidity of 20 to 40 percent but no more than 90 percent prior to, during and after installation.

1.08 SEQUENCING AND SCHEDULING

- A. Schedule installation of acoustic units after interior wet work is dry.
- B. Coordinate installation of ceilings with mechanical and electrical work

1.09 MAINTENANCE

- A. Extra Materials: Provide 5 percent extra quantity of each type of acoustical surface installed. Provide in original unbroken containers plainly marked with type and quantity of contents.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Suspended Acoustical Ceiling System, ACT-1
 - 1. Panels: Moisture resistant wet formed mineral fiber with factory applied vinyl latex paint, mold- and mildew-resistant, washable, scratch-resistant, soil-resistant, and with the following properties:
 - a. Size: 24 inches by 48 inches.
 - b. Thickness: 5/8-inch.
 - c. Edge: Square lay-in.
 - d. Light Reflectance: Minimum LR 0.80 in accordance with ASTM E1264.
 - e. Surface Burning Characteristics: Class A in accordance with ASTM E84, with flame spread 25 or under.
 - f. Color: White.
 - g. Texture: Smooth.
 - h. Product: As manufactured by Armstrong World Industries, Inc., "Cortega", or approved equal.
 - 2. Mechanical Suspension System: Heavy-duty, non-fire rated, exposed grid system for routed edge ceiling panels, double-web tees, steel body with exposed surfaces factory painted with baked polyester paint.
 - a. Provide panel centering devices built into each grid member.
 - b. Pull out tension values greater than 300 pounds.
 - c. Color: White.
 - d. Width: 15/16-inch.

- e. Product: As manufactured by Armstrong World Industries, Inc., "Prelude XL 15/16-Inch", or approved equal.
- B. Fasteners and Attachments
 - 1. Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft temper, with gauge in accordance with CBC.
 - 2. Angle-Type Hangers: Angles with legs not less than 7/8-inch wide, formed from 0.0635-inch thick galvanized steel sheet complying with ASTM A653, G90 Coating Designation, with bolted connections and 5/16-inch diameter bolts.
 - 3. Ceiling Clips: Minimum 13 gauge by 3/4-inch wide, as manufactured by Hilti, "Ceiling Clips"; Acoustical Surfaces, Inc., or approved equal.
 - 4. Light Fixture Protection and Hold Down Clips: Provide light fixture protection boards, fasteners and hold down clips as required by UL listing, manufacturer's standard types.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive acoustical treatment and verify that:
 - 1. Installation of building components located in ceiling plenum is complete.
 - 2. Spacing, direction and details of supports to accommodate installation of light fixtures, diffusers and other ceiling located items are correct.
 - 3. Areas are clean and free of materials or rubble that could damage acoustical surfaces.
- B. Do not start work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Suspended Ceiling Systems
 - 1. Install acoustical material and suspension system, including necessary hangers and other supporting hardware in accordance with manufacturer's instructions and ASTM C636.
 - 2. Lay work out symmetrically about centers of rooms and provide symmetrical borders not less than half size of tile specified unless noted otherwise on the Drawings.
 - 3. Make penetrations through ceiling panels in such a manner to ensure tight fit and neat appearance. Center penetrations in tile unless otherwise noted.
- B. Suspension System
 - 1. Install in accordance with CBC.
 - 2. For Hanger and Lateral Bracing Wires: Install expansion bolts or ceiling clips as required.
 - 3. Hanger Wires
 - a. Insert hanger wires around expansion bolts or through ceiling clips in accordance with Code and secure as specified for hanger wires following in this Article. Load test hanger wires as specified in Article titled "Field Quality Control" in this Section.
 - b. Plumb hanger wires. Add counterbrace wires when hanger wires are more than 1 in 6 out of plumb.
 - 4. Provide additional metal framing and hanger wires to clear furred-area interferences with suspension system. Do not penetrate ductwork with hanger wires.
 - 5. Ceiling wires and unbraced ducts, pipes and similar type items shall be separated by at least 6 inches.
 - 6. Provide hanger wires at intersection of grid members.
 - 7. Provide hanger wire supports for all recessed light fixtures and mechanical items as required for total support independent of acoustical ceiling systems.
 - 8. Use of scrap or short-cut members is not permitted.

9. Connect grid members with positive interlocking method as standard with reviewed manufacturer.
10. Secure ends of suspension system members at 2 adjacent walls as indicated and leave floating at other 2 adjacent walls.
11. Interconnect carriers over 12 inches not interconnected to walls near free end with 16 gauge tie wire or a metal strut securely attached to prevent spreading.
12. Level grid assembly in each area after installation of mechanical and electrical equipment within 1/8inch in 12 inches or conforming to slope as appropriate to area of installation.

3.03 FIELD QUALITY CONTROL

- A. Acoustical Ceiling Connection Devices: Test devices for capability to support the following loads:
 1. Hanger Wires: 100 pounds in accordance with requirements of CBC.
 2. Lateral Force Bracing Wires: 200 pounds or actual design load whichever is greater, with safety factor of 2, in accordance with CBC.

3.04 CLEANING AND ADJUSTING

- A. Remove damaged or soiled material and replace with new prior to the Owner's Project Manager's acceptance of Project.

3.05 PROTECTION

- A. Protect acoustical treatment installations from damage during remainder of construction.

END OF SECTION

SECTION 09 64 00**WOOD FLOORING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Wood flooring, WF-1.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 06 20 00 - Finish Carpentry: Provision of finish carpentry.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 2. F710 - Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.
 - 3. F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- B. FS - Federal Specifications
 - 1. HH-C-576 - Cork Sheet (Gaskets, Sheets, and Strips).
- C. NOFMA - The Wood Flooring Manufacturers Association
 - 1. Hardwood Flooring Installation Material.
 - 2. Official Flooring Grading Rules.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's data including descriptive literature and installation instructions for flooring and reducer strips.
- B. Samples: Submit 4 blocks of each species of wood flooring as follows:
 - 1. 2 samples, unfinished as received from manufacturer.
 - 2. 2 samples, with applied finish material.
- C. Quality Control Submittals: Submit manufacturer's installation instructions.

1.04 PROJECT CONDITIONS

- A. Environmental Requirements
 - 1. Store the wood flooring in the building or space where it is to be laid for a minimum of 3 days to allow any absorbed moisture to evaporate.
 - 2. Maintain the temperature of the building or space between 65 degrees Fahrenheit and 70 degrees Fahrenheit at least 5 days prior to installation and throughout the installation period.

1.05 MAINTENANCE

- A. Maintenance Service: Submit maintenance instructions.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Wood Strip Flooring, WDF-1: Solid construction, sourced from post-industrial fall down reclaimed from throughout the Pacific Northwest; recycled content, 100 percent pre-consumer. Comply with NOFMA's "Official Flooring Grading Rules" for species, grade, and cut.
 - 1. Species: *Pseudotsuga menziesii* (Fir).
 - 2. Character: Mixed grain with nail and other fastener holes, surface seasoning checks, tight, loose, and missing knots along with other signs of prior history and age.
 - 3. Thickness: 1/2-inch.
 - 4. Face Width: 5 inches.
 - 5. Lengths: 2 feet to 12 feet.
 - 6. Wear Layer: 1/4-inch thick.
 - 7. Finish: Manufacturer's Zero-VOC clear oil, low-VOC polyurethane, or unfinished as selected by the Architect.
 - 8. Product: As manufactured by TerraMai, "Mixed Grain Doug Fir Flooring", or approved equal.
- B. Subflooring: 3/4-inch thick, CDX plywood.
- C. Accessories
 - 1. Underlayment: Asphalt saturated organic felt, ASTM D226, Type I, No. 15 asphalt felt, unperforated.
 - 2. Fasteners: 8d screw type or cut nails.
 - 3. Cork Expansion Strip: Composition cork expansion strip FS HH-C-576, Type I-B, class 2.
 - 4. Reducer Strip: 2 inch wide tapered reducer strip in thickness, species and finish to match wood flooring.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting wood flooring performance. Verify that substrates and conditions are satisfactory for wood flooring installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with wood flooring installation.
 - 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 3. Concrete shall be allowed to cure for 90 to 120 days and must be properly sealed. Test concrete for vapor emission by the Calcium Chloride Moisture test method in compliance with ASTM F1869. Emission rate shall not exceed 3 lb/24 hr/1000 sq. ft.

3.02 INSTALLATION

- A. General
 - 1. Comply with flooring manufacturer's instructions and recommendations, but not less than that recommended in NOFMA's "Hardwood Flooring Installation Material" where applicable to type flooring required.
 - 2. Pattern: Comply with pattern or direction of pattern for laying wood flooring as indicated or, if not indicated, as directed by the Architect.

3. Expansion Space: Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4-inch unless otherwise indicated on the Drawings. Unless fully concealed by trim, fill expansion space with flush cork expansion strip.
- B. Solid Wood Flooring Installation: Blind nail flooring to substrate in accordance to NOFMA recommendations.
1. Selection of nail type is installer's option complying with flooring manufacturer's recommendations.
 2. Underlayment
 - a. Typical: Install flooring over 1 layer of building paper.
 - b. At "Warm Floors": Install flooring over 1 layer of vapor retarder.
 3. Reducer Strips: Install in accordance with manufacturer's instructions.
 4. Tolerances: Level resilient wood flooring system to a tolerance of 1/8-inch in 10 feet.
- C. Sanding
1. General: Perform sanding only after other interior work has been completed, and just prior to applying final finish coat to wood bases.
 2. Preparation: Prior to sanding sweep floor clean. Do not use any water.
 3. Perform sanding by machine, unless otherwise specified herein.
 4. Traverse floors several times working first traverse across the grain and then lengthwise with the grain, starting with No. 2 sandpaper on the second traverse, and with No. 0 or No 00 sandpaper on the third and fourth traverse.
 5. Then flooring shall receive final buffing or cleaning with fine sandpaper or No. 0 steel wool by machine or by hand.
 6. After sanding is complete, wait at least 24 hours before applying finishing system.
- D. Finishing
1. Verify with the Architect before proceeding.
 2. Apply finish material in accordance with manufacturer's installation instructions and as required to match reviewed sample.
 3. Apply minimum 4 coats of finishing materials, or as directed by the Architect.

3.03 PROTECTION

- A. After completion of laying, and the finishing and drying of floors, protect flooring immediately with nonstaining, non-asphalt type kraft building paper. Edges of paper shall be lapped and taped. Taping residue shall not be allowed on finish flooring. At Project completion and acceptance, carefully take up and remove the protective paper covering from the job site.

END OF SECTION

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SECTION 09 65 00**RESILIENT FLOORING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Linoleum tile, RF-1.
 - 2. Rubber wall base, RB-1.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 03 54 16 - Hydraulic Cement Underlayment: Provision of underlayment at flooring installations.
 - 2. Section 07 92 00 - Joint Sealants: Provision of sealers and caulks.
 - 3. Section 09 68 13 - Tile Carpeting: Provision of carpet tile.

1.02 REFERENCES

- A. ADA - Americans with Disabilities Act
- B. ASTM - American Society for Testing and Materials
 - 1. E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 - 2. E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 - 3. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 4. F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- C. CALGreen - California Green Building Standards, 2022 Edition

1.03 SYSTEM DESCRIPTION

- A. Adhesives used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Article 5.504.4.1.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each type of product specified.
- B. Samples: Submit samples for initial selection purposes in form of manufacturer's color charts consisting of actual sections of linoleum and bases showing full range of colors and patterns available for each different product indicated.

1.05 MAINTENANCE

- A. Extra Materials
 - 1. Furnish 50 additional tiles of each class, wearing surface, color, pattern, and size of resilient floor tile installed.

2. Furnish 100 linear feet in roll form of each different composition, wearing surface, color, and pattern of resilient wall base installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers
 1. Linoleum Tile: Forbo Flooring, Inc., "Marmoleum Modular", or approved equal.
 2. Rubber Wall Base: Mannington Commercial, "BurkeBase", or approved equal.

2.02 MATERIALS

- A. Linoleum Tile, RF-1: Consisting of linseed oil, wood flour, rosin binders, and pigments mixed and calendered onto a natural polyester jute backing, with the following properties:
 1. Gauge: 1/10-inch.
 2. Size: 18 inches by 18 inches.
 3. Installation: Quarter turn.
 4. Static Load Limit: Exceeds 700 psi in accordance with ASTM F970.
 5. Slip Resistance: Meets or exceeds ADA recommendations of 0.6 for flat surfaces.
 6. Fire Resistance
 - a. Smoke Density: 450 or less in accordance with ASTM E662.
 - b. Critical Radiant Flux: Class 1 in accordance with ASTM E648.
 7. Color: Dove Grey, MCT621.
- B. Rubber Wall Base, RB-1: Products complying with ASTM F1861.
 1. Type: Straight (toeless).
 2. Minimum Nominal Thickness: 1/8-inch.
 3. Height: 4 inches.
 4. Lengths: Coils in lengths standard with manufacturer but not less than 100 feet.
 5. Interior and Exterior Corners and Ends: Premolded.
 6. Color: Vapor Grey CG, 23, solid color.

2.03 INSTALLATION ACCESSORIES

- A. Adhesives (Cements): Waterproof type recommended by tile manufacturer to suit resilient floor tile products and substrate conditions indicated, as manufactured by Master Builders, "Concresive Paste LPL", or approved equal.
- B. Caulking: Acrylic latex silicon caulk as specified in Section 07 92 00. When adjacent materials are different colors, notify the Architect for direction on which caulk color to use.
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of linoleum floor coverings and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:
 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

3. Concrete shall be allowed to cure for 90 to 120 days and must be properly sealed. Test concrete for vapor emission by the Calcium Chloride Moisture test method in compliance with ASTM F1869. Emission rate shall not exceed 3 lb/24 hr/1000 sq. ft. Treat with vapor emission treatment systems as required.

3.02 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.
- B. Do not install floor coverings until they are same temperature as space where they are to be installed.
 1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- C. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.03 INSTALLATION

- A. General: Comply with manufacturers' installation directions and other requirements indicated that are applicable to each type of installation included in Project.
- B. Linoleum Tile Installation
 1. Lay out tiles 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 at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.
 2. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
 - a. Lay tiles quarter-turn.
 3. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including, pipes, outlets, edgings, thresholds and nosings.
 4. Extend tiles into toe spaces, door reveals, closets, and similar openings.
 5. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.
 6. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.
 7. Use full spread of adhesive applied to substrate in compliance with tile manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.
 8. Hand roll tiles where required by tile manufacturer.
- C. Resilient Wall Base Installation
 1. Apply resilient wall base to walls, casework and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 2. Place resilient accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.

3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing installation:
 - 1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers.
 - 2. Sweep or vacuum floor thoroughly.
 - 3. Do not wash floor until after time period recommended by manufacturer.
 - 4. Damp-mop resilient flooring and accessories to remove black marks and soil.
- B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by tile manufacturer.

END OF SECTION

SECTION 09 68 13**TILE CARPETING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Carpet tile, CPT-1.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 03 54 16 - Hydraulic Cement Underlayment: Provision of underlayment at flooring installations.
 - 2. Section 09 30 00 - Tiling: Provision of ceramic tile.
 - 3. Section 09 65 00 - Resilient Flooring: Provision of resilient base.

1.02 REFERENCES

- A. ADA - Americans with Disabilities Act
- B. ASTM - American Society for Testing and Materials
 - 1. D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
 - 2. E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 - 3. F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 4. F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- C. BAAQMD - Bay Area Air Quality Management District
 - 1. Regulation 8 - Organic Compounds, Rule 51 - Adhesive and Sealant Products.
- D. CALGreen - California Green Building Standards, 2022 Edition
- E. CRI - Carpet and Rug Institute
 - 1. 104 - Standard for Installation of Commercial Carpet.
- F. DOC - Department of Commerce
 - 1. FF 1-70 - Methenamine Pill Test.
- G. EPA - Environmental Protection Agency
- H. FCICA - Floor Covering Installation Contractors Association
- I. NFPA - National Fire Protection Association
 - 1. 253 - Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
 - 2. 258 - Recommended Practice for Determining Smoke Generation of Solid Materials.
- J. SCAQMD - South Coast Air Quality Management District
 - 1. Rule 1168 - Adhesive Applications, October, 2003 Amendment.

- K. UL - Underwriters Laboratories Inc.

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements
1. Adhesives used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Article 5.504.4.1.
 2. All interior sealants used as fillers shall meet or exceed the BAAQMD Reg. 8, Rule 51 VOC requirements; all interior adhesives and other types of sealants shall meet or exceed the SCAQMD Rule 1168 VOC requirements.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each type of carpet material and installation accessory required. Submit written data on physical characteristics, durability, resistance to fading, and flame resistance characteristics.
- B. Shop Drawings: Submit shop drawings showing layout and seaming diagrams. Indicate pile or pattern direction and locations and types of edge strips. Indicate columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet. Show installation details at special conditions.
- C. Samples
1. Submit three 12-inch square samples of each carpet type illustrating color, weave, texture, and pattern.
 2. Submit manufacturer's full range of color selections for carpet edge strips.
- D. Contract Closeout Submittals: Include the following information in maintenance manuals:
1. Methods for maintaining carpet tile, 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 tile.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by FCICA or who can demonstrate compliance with its certification program requirements.
- B. Regulatory Requirements
1. Carpet floor coverings shall have minimum critical radiant flux limit of 0.22 watts/cm² when tested in accordance with NFPA 253. Such rating shall be maintained for distance of 5 feet on all sides of fire door except as otherwise prohibited by building design and construction.
 2. Carpet Surface Burning Characteristics: Provide carpet identical to that tested for the following fire performance characteristics, per test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify carpet with appropriate markings of applicable testing and inspecting organization.
 - a. Test Method: DOC FF 1-70.
 - b. Rating: Pass.
 3. NBS Smoke Chamber Test: Exceed test requirements with maximum specific optical density of 350 or less in the flaming mode.
 4. Striping for Visually Impaired: Conform to ADA requirements for strip of clearly contrasting color at least 2 inches wide placed parallel to and not more than 1 inch from nose of upper approach and lower tread of each stair.
 5. Carpet pile height shall meet requirements of ADA.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Acceptance at Site: Deliver materials to Project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.
- B. Storage and Protection: Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, blocked off ground. Maintain minimum temperature of 68 degrees Fahrenheit at least 3 days prior to and during installation in area where materials are stored.

1.07 PROJECT CONDITIONS

- A. Substrate Conditions: No condensation within 48 hours on underside of 4 feet by 4 feet polyethylene sheet, fully taped at perimeter to substrate.
- B. Substrate Conditions: pH of 9 or less when substrate wetted with potable water and pHydron paper applied.
- C. Environmental Limitations: Comply with CRI 104, Section 6.1. Do not install carpet tile until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.08 WARRANTY

- A. Unless otherwise noted, manufacturer's 15 years written warranty for new carpet tiles or 7 years for reprocessed re-used carpet tiles. Warranty periods above shall be from date of Substantial Completion. Warranty shall be submitted to the Owner's Representative against product failure covering both labor and material in the following areas:
 - 1. Edge ravel.
 - 2. Secondary back adhesion.
 - 3. Average 20 pounds tuft bind.
 - 4. No more than 10 percent face yarn loss.
 - 5. Static control protection.

1.09 MAINTENANCE

- A. Extra Materials
 - 1. Deliver extra materials to the Owner's Representative. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels describing contents.
 - 2. Carpet Tile: Full-size units equal to 3 percent of amount installed for each type indicated, but not less than 6 sq. yd.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Carpet Tile, General
 - 1. Flammability: NBS smoke chamber NFPA 258, less than 450 flaming mode.
 - 2. Flooring Radiant Panel: Meets NFPA Class 1 when tested in accordance with ASTM E648 glue down.

3. Odor Emissions: Carpet shall be void of 4--phenylcyclohexene, a by product of SBR latex.
 4. VOC Limits: Provide carpet that complies with the following limits for VOC content when tested according to ASTM D5116:
 - a. Total VOCs: 0.5 mg/sq. m x h.
 - b. 4-PC (4-Phenylcyclohexene): 0.05 mg/sq. m x h.
 - c. Formaldehyde: 0.05 mg/sq. m x h.
 - d. Styrene: 0.4 mg/sq. m x h.
 5. Carpet shall economically maximize the following appearance retention characteristics:
 - a. Minimize crushing and matting.
 - b. Manage dry soil concerns and ease of maintenance.
 - c. Manage staining.
 - d. Eliminate seam failure and unravelling.
 - e. Eliminate moisture exposure concerns.
 - f. Minimize loss of coloration and fading.
- B. Carpet Tile, CPT-1
1. Size: 9.845 inches by 39.38 inches.
 2. Construction: Engaged tufted sheared.
 3. Yarn: 100 percent recycled content nylon.
 4. Dye Method: 100 percent solution dyed.
 5. Tufted Yarn Weight: 32 ounces/square yard.
 6. Machine Gauge: 1/10-inch.
 7. Pile Height: 0.24-inch.
 8. Pile Thickness: 0.194-inch.
 9. Stitches: 7.5 per inch.
 10. Backing: GlasBac.
 10. Color: Limestone.
 11. Product: As manufactured by Interface, "Human Nature Collection, HN850", or approved equal.
- C. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
1. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D5116.
 - a. Total VOCs: 50 g/L.
 - b. Formaldehyde: 0.05 mg/sq. m x h.
 - c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.
- D. Transition Strip at Ceramic Tile: Mill-finished anodized aluminum; 3/4-inch wide; 3/16-inch high; length as indicated; fluted finish.
1. Product: As manufactured by Assa Abloy, "Pemko 2604A", or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

3. Concrete shall be allowed to cure for 90 to 120 days and must be properly sealed. Test concrete for vapor emission by the Calcium Chloride Moisture test method in compliance with ASTM F1869. Emission rate shall not exceed 3 lb/24 hr/1000 sq. ft. Treat with vapor emission treatment systems as required.

3.02 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation", and carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.02 INSTALLATION

- A. Comply with CRI 104, Section 13.
- B. Carpet shall be installed after building has been painted and subjected to an airing out of at least a week by forced ventilation, with maximum outside air. Contractor shall ensure construction involving high VOCs and other pollutant will be completed before the airing out.
- C. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- D. Comply with manufacturer's recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under door in closed position; do not place seams perpendicular to door frame, in direction of traffic through doorway. Do not bridge building expansion joints with continuous carpet.
- E. Extend carpet under removable flanges and furnishings and into alcoves and closets of each space.
- F. Provide cutouts where required, and bind cut edges where not concealed by protective edge guards or overlapping flanges. Maintain reference markers, holes and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.
- H. Install quarter-turn, unless otherwise indicated.
- I. Do not bridge building expansion joints with carpet.
- J. Observe CRI and EPA carpet air-out guidelines.
 1. Continuously operate the building ventilation system at normal temperature and maximum outdoor air during installation and for 72 hours after installation is complete. Avoid recirculating air from the installation area, through the heating, ventilation and air-conditioning system, and into occupied areas. Create a temporary exhaust system using fans, open doorways, stairwells and windows. Seal return air grilles.
- K. Provide carpet tiles larger than 1/2 tile to the Owner's Representative as additional material above the 5 percent extra materials specified above.

3.03 CLEANING

- A. Remove adhesive from carpet surface with manufacturer's recommended cleaning agent.
- B. Remove and dispose of debris and unusable scraps. Vacuum with commercial machine with face-beater element. Remove soil. Replace carpet where soil cannot be removed. Remove protruding face yarn. Vacuum carpet.

3.04 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, to ensure carpet is not damaged or deteriorated at time of Substantial Completion.

END OF SECTION

SECTION 09 72 00**WALL COVERINGS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Wall covering at Children's Room, WC-1.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 06 41 10 - Custom Casework: Provision of custom casework.
 - 2. Section 09 29 00 - Gypsum Board: Provision of gypsum board substrate.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. FS - Federal Specifications
 - 1. CCC-W-408A - Wall Covering, Vinyl Coated.
- C. UL - Underwriters Laboratories Inc.

1.03 SUBMITTALS

- A. Product Data: Submit product data for each type of product specified. Include data on custom graphics, physical characteristics, durability, fade resistance, and flame-resistance characteristics.
- B. Shop Drawings: Submit shop drawings showing location and extent of each wall covering type. Indicate seams and termination points.
- C. Samples: Submit samples for verification in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
 - 1. Wall Covering Material: Full-width sample, not less than 36 inches long, from dye lot used for the Work.
 - a. Submit sample with specified treatments applied.
 - b. Mark top and face of material.
 - c. Show complete pattern repeat.
- D. Schedule of wall coverings using same room designations indicated on the Drawings.
- E. Contract Closeout Submittals: Submit maintenance data for wall covering to be included in the operation and maintenance manual specified in Division 01.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed 5 projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

- B. Fire Test Response Characteristics: Provide wall coverings with the following surface burning characteristics as determined by testing identical products per ASTM E84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Flame Spread: 25 or less.
 - 2. Smoke Developed: 50 or less.

1.05 PROJECT CONDITIONS

- A. Space Enclosure and Environmental Limitations: Do not install wall covering until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.
- B. Lighting: Do not install wall covering until a lighting level of not less than 15 foot-candles is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering manufacturer for full drying or curing.

1.06 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Rolls of Wall Covering Material: Full-size units equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Koroseal; Calico, or approved equal.

2.02 MATERIALS

- A. Wall Covering at Children's Room, WC-1: Vinyl-coated woven poly-cotton fabric graphic; installed over GWB-2 finish as specified in Section 09 29 00.
 - 1. Thickness: 0.018-inch to 0.026-inch.
 - 2. Width: 51 inches.
 - 3. Standard: FS CCC-W-408A Type II.
 - 4. Fire Rating: Class A.
 - 5. Pattern: Non-repeating custom layout.
 - 6. Color: Svad.
 - 7. Product: As manufactured by Calico, "Aura", or approved equal.
- B. Adhesives: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application, as recommended by wall covering manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates for compliance with requirements for moisture content and other conditions affecting performance of Work of this Section.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt.
- C. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.
 - 1. Prime new fiberboard with primer recommended by wall covering manufacturer.
- D. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.03 INSTALLATION, GENERAL

- A. General
 - 1. Comply with wall coverings manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 2. Install over gypsum wall board with Level 5 finish, as specified in Section 09 29 00.
- B. Cut wall covering panels in roll number sequence. Change run numbers at partition breaks and corners only.
- C. Install wall covering with no gaps or overlaps.
- D. Match pattern 72 inches above finish floor.
- E. Install vertical seams vertical and plumb at least 6 inches from outside corners and 3 inches from inside corners. Install horizontal seams level at least 6 inches from outside corners and 3 inches from inside corners.
- F. Remove air bubbles, wrinkles, blisters, and other defects.
- G. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams.

3.04 CLEANING

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended by wall covering manufacturer.
- C. Replace strips that cannot be cleaned.

END OF SECTION

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SECTION 09 90 00**PAINTING AND COATING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Surface preparation, painting, and finishing of new and existing exposed exterior and interior items and surfaces.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Division 01 - General Requirements: For alternates.
 - 2. Section 05 50 00 - Metal Fabrications: For finish painting of metal fabrications.
 - 3. Section 06 20 00 - Finish Carpentry: For finish painting of finish carpentry.
 - 4. Section 06 41 10 - Custom Casework: For finish painting of custom casework.
 - 5. Section 07 62 00 - Sheet Metal Flashing and Trim: For finish painting of sheet metal flashing and trim.
 - 6. Section 08 14 16 - Flush Wood Doors: For finish painting of flush wood doors.
 - 7. Section 08 31 13 - Access Doors and Frames: For finish painting of access doors and frames.
 - 8. Section 09 29 00 - Gypsum Board: For finish painting of gypsum board.
 - 9. Section 10 44 00 - Fire Protection Specialties: For field finish painting of fire extinguisher cabinets.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- B. CALGreen - California Green Building Standards, 2022 Edition
- C. CFR - Code of Federal Regulations
 - 1. 40 CFR 59 - National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.
- D. EPA - Environmental Protection Agency
- E. FM - Factory Mutual
- F. SSPC - The Society for Protective Coatings
 - 1. SP 10 - Surface Preparation Specification No. 10: Near-White Blast Cleaning.
- G. UL - Underwriters Laboratories Inc.

1.03 DEFINITIONS

- A. "Paint": As used herein, means coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate or finish coats.

- B. Standard coating terms defined in ASTM D16 apply to this Section.
 - 1. "Flat": Refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. "Eggshell": Refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 - 3. "Semigloss": Refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 - 4. "Full Gloss": Refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.04 SYSTEM DESCRIPTION

- A. Performance Requirements
 - 1. Paint exposed surfaces whether or not colors are designated in the schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
 - 2. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts and labels.
 - 3. Do not paint over UL, FM, or other code required labels or equipment name, identification, performance rating or nomenclature plates.
- B. Paints and coatings used on the Project shall comply with CALGreen Code Nonresidential Mandatory Measures, Chapter 5, Division 5.5, Section 5.504, Article 5.504.4.3.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each paint system specified, including block fillers and primers.
 - 1. Provide manufacturer's technical information including label analysis and instructions for handling, storage and application of each material proposed for use.
 - 2. List each material and cross reference the specific coating, finish system and application. Identify each material by the manufacturer's catalog number and general classification.
- B. Samples
 - 1. Following the selection of colors and glosses by the Architect, submit samples for the Architect's review.
 - a. Provide 1 sample of each color and each gloss for each material on which the finish is specified to be applied.
 - b. Except as otherwise directed by the Architect, make samples approximately 8 inches by 10 inches in size.
 - c. Provide field mockups for final paint color and texture approval in the form of actual application of the materials on actual surfaces to be painted for approval by the Architect. Areas shall be 4 feet by 4 feet.
 - 2. Revise and resubmit each sample or field mockup as requested until the required gloss, color and texture are achieved. Such samples or field mockups, when approved, will become standards of color and finish for accepting or rejecting the work of this Section.
 - 3. Do not commence finish painting until approved samples are on file at the job site.
- C. Quality Control Submittals: Provide certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.06 QUALITY ASSURANCE

- A. Provide primers and undercoat paint produced by the same manufacturer as finish coats.
 - 1. Review other Sections of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrates.
 - 2. Upon request, furnish information on the characteristics of the specific finish materials to assure that compatible prime coats are used.
 - 3. Provide barrier coats over non-compatible primers or remove the primer and re-prime as required.
 - 4. Notify the Architect in writing of anticipated problems in using the specified coating systems over prime coatings supplied under other Sections.
- B. Applicator Qualifications: Use 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.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site: Deliver materials to the job 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.
- B. Storage and Protection
 - 1. Store materials not in use in tightly covered containers in well ventilated area at minimum ambient temperature of 45 degrees Fahrenheit. Maintain containers used in storage in clean condition, free of foreign materials and residue.
 - 2. Protect from freezing. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.08 PROJECT CONDITIONS

- A. Environmental Requirements
 - 1. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees and 90 degrees Fahrenheit, unless otherwise permitted by the manufacturers' printed instructions as approved by the Architect.
 - 2. Do not apply solvent-thinned paints when the temperature of surfaces to be painted and the surrounding air temperatures are below 45 degrees Fahrenheit, unless otherwise permitted by the manufacturers' printed instructions as approved by the Architect.
 - 3. Do not apply paint in rain, fog, or mist; or when the relative humidity exceeds 85 percent. Do not apply paint to damp or wet surfaces, unless otherwise permitted by the manufacturers' printed instructions as approved by the Architect.
 - 4. Applications may be continued during inclement weather only within the temperature limits specified by the paint manufacturer as being suitable for use during application and drying periods.

1.09 MAINTENANCE

- A. Upon completion of the work of this Section, deliver to the Owner's Project Manager an extra stock of 5 gallons of each color, type, and gloss of exterior and interior paint used in the Work, tightly sealing each container, and clearly labeling with contents and location where used.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturer: Benjamin Moore, or approved equal.

2.02 PAINT MATERIALS

- A. General
1. Paint Materials, General: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer, based on testing and field experience.
 2. Material Quality: Provide manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
 3. Chemical Components of Field-Applied Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:
 - a. VOC Content of Interior Paints and Coatings: Not more than 5 g/L.
 - b. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - c. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1) Acrolein.
 - 2) Acrylonitrile.
 - 3) Antimony.
 - 4) Benzene.
 - 5) Butyl benzyl phthalate.
 - 6) Cadmium.
 - 7) Di (2-ethylhexyl) phthalate.
 - 8) Di-n-butyl phthalate.
 - 9) Di-n-octyl phthalate.
 - 10) 1,2-dichlorobenzene.
 - 11) Diethyl phthalate.
 - 12) Dimethyl phthalate.
 - 13) Ethylbenzene.
 - 14) Formaldehyde.
 - 15) Hexavalent chromium.
 - 16) Isophorone.
 - 17) Lead.
 - 18) Mercury.
 - 19) Methyl ethyl ketone.
 - 20) Methyl isobutyl ketone.
 - 21) Methylene chloride.
 - 22) Naphthalene.

- 23) Toluene (methylbenzene).
- 24) 1,1,1-trichloroethane.
- 25) Vinyl chloride.
- 4. Colors and Sheens
 - a. PT-1: Benjamin Moore Super White, BM OC-152; eggshell at wall and casework.
 - b. PT-2: Benjamin Moore Super White, BM-OC-152; flat at ceiling.
 - c. PT-3: Benjamin Moore Black Iron, BM Exterior 2120-20; semi-gloss at exterior steel deck, guardrails, and interior book stacks.

2.03 APPLICATION EQUIPMENT

- A. For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint, and as approved by the Architect.
- B. Prior to use of application equipment, verify that the proposed equipment is actually compatible with the material to be applied, and that integrity of the finish will not be jeopardized by use of the proposed equipment.

2.04 OTHER MATERIALS

- A. Provide other materials not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.01 PREPARATION

- A. General: Mix and prepare paint materials in strict accordance with the manufacturers' recommendations as approved by the Architect.
- B. Surface Preparation
 - 1. General
 - a. Perform preparation and cleaning procedures in strict accordance with the paint manufacturers' recommendations as approved by the Architect.
 - b. Remove removable items which are in place and are not scheduled to receive paint finish; or provide surface applied protection prior to surface preparation and painting operations.
 - c. Following completion of painting in each space or area, reinstall the removed items by using workmen who are skilled in the necessary trades.
 - 2. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall onto wet newly painted surfaces.
- C. Preparation of Wood Surfaces
 - 1. Clean wood surfaces until free from dirt, oil, and other foreign substance.
 - 2. Smooth finished wood surfaces exposed to view, using the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.
 - 3. Unless specifically approved by the Architect, do not proceed with painting of wood surfaces until the moisture content of the wood is 12 percent or less as measured by a moisture meter approved by the Architect.

- D. Preparation of Metal Surfaces
 - 1. Thoroughly clean surfaces until free from dirt, oil and grease.
 - 2. Allow to dry thoroughly before application of paint.
 - 3. Aluminum Substrates: Remove surface oxidation.

3.02 PAINT APPLICATION

- A. General
 - 1. Touch-up shop-applied prime coats which have been damaged, and touch-up bare areas prior to start of finish coats application.
 - 2. Slightly vary the color of succeeding coats.
 - 3. Sand and dust between coats to remove defects visible to the unaided eye from a distance of 5 feet.
 - 4. On removable panels and hinged panels, paint the back sides to match the exposed sides.
 - 5. When patch painting, paint to nearest breakpoint or entire plane if whole room; refer to Finish Schedule.
- B. Drying: Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suite adverse weather conditions.
- C. Brush Applications
 - 1. Brush out and work the brush coats onto the surface in an even film.
 - 2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.
- D. Spray Application
 - 1. Confine spray application to metal framework and similar surfaces where hand brush work would be inferior.
 - 2. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.
 - 3. Do not double back with spray equipment to build up film thickness of 2 coats in 1 pass.
- E. Miscellaneous Surfaces and Procedures
 - 1. Exposed Mechanical Items
 - a. Finish access doors, conduits, pipes, ducts, grilles, registers, vents and items of similar nature to match the adjacent wall and ceiling surfaces, or as directed.
 - b. Paint visible duct surfaces behind vents, registers, and grilles flat black.
 - c. Wash metal with solvent, prime and apply 2 coats of alkyd enamel.
 - 2. Exposed Pipe and Duct Insulation
 - a. Apply 1 coat of latex paint on insulation which has been sized or primed under other Sections; apply 2 coats on such surfaces when unprepared.
 - b. Match color of adjacent surfaces.
 - c. Remove band before painting and replace after painting.
 - 3. Hardware
 - a. Paint prime coated hardware to match adjacent surfaces;
 - b. Paint metal portions of head seals, jamb seals, and astragal seals to match the color of the door frame unless otherwise directed by the Architect.
 - 4. Wet Areas
 - a. For oil base paints, use 1 percent phencimercuric or 4 percent tetrachlorophenol.
 - b. For water emulsion and glue size surfaces, use 4 percent sodium tetrachlorophenate.

3.03 EXTERIOR PAINT SCHEDULE

- A. Transparent Finish for Wood Where Indicated
 - 1. Waterborne, Satin-Varnish Finish: 3 finish coats of a waterborne, clear-satin varnish.
 - a. First, Second, and Third Finish Coats: Waterborne acrylic urethane varnish finish applied at spreading rate recommended by the manufacturer.
- B. Ipe Wood Treatment, Alternate #1 and Alternate #3: Low-VOC hardwood finish; oil-based formula penetrates deeply to nourish and seal the wood from within; trans-oxide pigments protect against intense UV exposure while maintaining the wood's natural grain and color with a clean, matte appearance.
 - 1. Product: As manufactured by DeckWise, "Ipe Oil Plus 100 VOC", or approved equal.
- C. Semi-Gloss Acrylic Enamel Finish for Ferrous and Galvanized Metals: 2 finish coats over a primer.
 - 1. Primer: Exterior acrylic-latex primer applied at spreading rate to achieve a total dry film thickness as recommended by the manufacturer.
 - 2. First and Second Coats: Semi-gloss, exterior, acrylic-latex enamel applied at spreading rate to achieve a total dry film thickness as recommended by the manufacturer.

3.04 INTERIOR PAINT SCHEDULE

- A. Finishes for Gypsum Board
 - 1. Eggshell at Walls: Finish coat(s) to cover over a primer.
 - a. Primer: Latex based, interior primer applied at spreading rate required to achieve a total dry film thickness as recommended by the manufacturer.
 - b. Finish Coat: Low luster eggshell, acrylic-latex based, interior enamel applied at spreading rate required to achieve a total dry film thickness as recommended by the manufacturer.
 - 2. Flat at Ceilings: Finish coat(s) to cover over a primer.
 - a. Primer: Latex based, interior primer applied at spreading rate required to achieve a total dry film thickness as recommended by the manufacturer.
 - b. Finish Coat: Flat, acrylic latex, interior enamel applied at spreading rate required to achieve a total dry film thickness as recommended by the manufacturer.
- B. Transparent Finish for Wood Where Indicated
 - 1. Waterborne, Satin-Varnish Finish: 3 finish coats of a waterborne, clear-satin varnish.
 - a. First, Second, and Third Finish Coats: Waterborne acrylic urethane varnish finish applied at spreading rate recommended by the manufacturer.
- C. Opaque Finish for Wood
 - 1. Eggshell Finish: Finish coat(s) to cover over a primer.
 - a. Primer: Latex based, interior primer applied at spreading rate required to achieve a total dry film thickness as recommended by the manufacturer.
 - b. Finish Coat: Low luster eggshell, acrylic-latex based, interior enamel applied at spreading rate required to achieve a total dry film thickness as recommended by the manufacturer.
- D. Semi-Gloss Acrylic Enamel Finish for Ferrous and Galvanized Metals: 2 finish coats over a primer.
 - 1. Primer: Interior acrylic-latex primer applied at spreading rate to achieve a total dry film thickness as recommended by the manufacturer.
 - 2. First and Second Coats: Semi-gloss, interior, acrylic-latex enamel applied at spreading rate to achieve a total dry film thickness as recommended by the manufacturer.

END OF SECTION

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SECTION 10 14 00**SIGNAGE****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Exterior powder-coated stainless steel letterform signage as indicated.
 - 2. Exterior UV-compliant acrylic signage as indicated.
 - 3. Interior code-compliant acrylic signage with opaque backing as indicated.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 REFERENCES

- A. ADA - Americans with Disabilities Act
- B. CBC - California Building Code, 2022 Edition

1.03 SYSTEM DESCRIPTION

- A. Design Requirements: Design all signs as required by ADA and CBC - Title 24.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with ADA and CBC requirements for signage, to include Braille.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's product data describing materials and signs.
- B. Shop Drawings
 - 1. Provide shop drawings showing construction details for approval before proceeding with fabrication. Include full size details of exposed edges, joints between materials, hanging, hinging and locking systems and any other details which would affect sign appearance.
 - 2. Fasteners: Detail methods of fastenings and provide exact specifications for all fasteners noted on shop drawings.
 - 3. Artwork: Submit full size patterns or prints of typical copy layouts and/or graphic elements to be applied on signs. Using layouts on the Drawings as a guide, optically enlarge and hand correct images before submitting to the Architect for approval before fabrication.
 - 4. Sign Location: Provide Graphic Schedule and location plans to identify and locate all signs. Item numbers listed in the Graphic Schedule shall be found on location plans and shall identify locations of specific sign items.
- C. Samples
 - 1. On 6-inch by 6-inch pieces of actual sign materials, submit to the Architect for review and approval, 3 samples of painted and graphic finishes, in each material, color and finish, with texture to simulate actual conditions.
 - 2. Provide listing of the material and application for each coat of each finish sample.

3. Be prepared to resubmit each sample as requested until required sheen, color and texture are approved.
 4. Acrylic: Submit color and finish samples of plastics for approval before proceeding with fabrication. No substitution in color, thickness, finish or plastics will be accepted without written approval of the Architect.
 5. Fasteners: Submit 1 sample of all fasteners and hardware for approval.
 6. Paint: Submit 3 color and finish samples of all paints and finishes for approval prior to fabrication.
- D. Operation and Maintenance: Provide the Owner's Project Manager with proper cleaning instructions required for continued maintenance of signs.

1.06 QUALITY ASSURANCE

- A. Pre-Installation Conferences: Sign locations shown on the location plans are for general information only. Prior to installation and as required, arrange meetings with the Architect at the site for final location for all sign items.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: ASI Sign Systems, Inc., or approved equal.
1. Font shall be as selected by the Architect for acrylic and vinyl signage.

2.02 MATERIALS

- A. Plastic Signs: Matte finish acrylic plastic, minimum 1/8-inch thick, without frame, with corners radiused. Message and background color shall be sub-surface printed. Provide with raised room numbers and Braille where indicated.
1. At exterior, provide UV-compliant acrylic, white color as indicated.
- B. Vinyl Letters: As selected by the Architect.
- C. Metal Letters: Exterior, stainless steel, powder-coated finish, per Architect's digital CAD file, as selected by the Architect.
- C. Mounting Tape: Double-sided vinyl foam tape, "VHB" by 3M, or approved equal. Provide silicone adhesive for attachment to wall surface.
- D. Fasteners: Where fasteners are indicated or required, use exposed "torx type" tamper-proof security screws.
- E. Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are non-fading for the application intended.

2.03 ACRYLIC SIGNS

- A. Acrylic and Vinyl Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
1. Font shall be provided by the Architect.
- B. Unframed Acrylic Signs: Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:
1. Edge Condition: Square cut.

2. Corner Condition: 1/2-inch radius.
 3. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16-inch measured diagonally.
- C. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.
- D. Message Inserts: Where sign type makes provision for changeable name slots, provide laser printed name strips with text as scheduled. Obtain message from the Owner's Project Manager before fabrication. Where no text is scheduled, insert blank message strip in slot for future text by the Owner's Project Manager.
- E. Photopolymer (Raised Copy): Machine-cut copy characters from matte finish opaque acrylic sheet and chemically weld onto the acrylic sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.
1. Panel Material: Matte-finished acrylic stock with opaque color coating surface applied; 2 colors, minimum 70 percent contrast between color 1 and color 2.
 2. Raised Copy Thickness: Not less than 1/32-inch.

2.04 BRAILLE SYMBOLS

- A. Braille Symbols: California Contracted Grade 2 Braille shall be used wherever Braille symbols are specifically required in other portions of these standards. Dots shall be 1/10-inch on centers in each cell with 2/10-inch space between cells. Dots shall be raised a minimum of 1/40-inch above the background.

2.05 FINISHES

- A. Colors: For exposed sign material that requires applied colors and other characteristics related to appearance, see Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the substrate and conditions in which the work is to be installed. Correct all unsatisfactory substrate and conditions prior to start of installation.

3.02 INSTALLATION

- A. General
1. Install signage in neat and proper manner.
 2. Install sign items, including all components, in accordance with reviewed Graphic Schedule at locations shown.
 3. Install signs properly aligned, level and true to line and dimension.
- B. Install with reviewed manufacturer's adhesive or mechanical fasteners after application of finish painting at heights noted.

3.03 SCHEDULE

- A. Signage font, size, color and background color as indicated on the Drawings.
1. Font shall be as selected by the Architect for acrylic and vinyl signage.

- B. Signage shall be in compliance with CBC.

END OF SECTION

SECTION 10 28 13**TOILET ACCESSORIES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Toilet accessories, including backing plates for grab bars.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 REFERENCES

- A. ADA - Americans with Disabilities Act
- B. AISI - American Iron and Steel Institute
- C. ASTM - American Society for Testing and Materials
 - 1. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3. B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - 4. C1503 - Standard Specification for Silvered Flat Glass Mirror.
 - 5. F446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.
- D. CBC - California Building Code, 2022 Edition

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gauges, profiles, mounting method, specified options, and finishes.
- B. Contract Closeout Submittals: Submit maintenance instructions including replaceable parts and service recommendations.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements
 - 1. Grab Bars and Fasteners: Strength of grab bars, fasteners and mounting devices shall comply with CBC and ADA requirements.
 - 2. Grab Bar Surfaces: Conform to CBC.
 - 3. Mounting Heights of Accessories: Comply with requirements of CBC.
 - 4. Operating Pressure for Soap Dispensers: Comply with ADA.
- B. Inserts and Anchorages: Furnish accessory manufacturers' standard concealed inserts and anchoring devices. Coordinate delivery with other work to avoid delay.

1.05 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

1.06 WARRANTY

- A. Warranty: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within warranty period.
- B. Warranty Period: 10 years from date of Substantial Completion.
- C. Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: Bobrick Washroom Equipment, Inc.; Dyson, or approved equal.

2.02 MATERIALS

- A. General: Fabricate toilet accessory items from the following materials and according to requirements specified for individual accessory items.
 - 1. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gauge minimum thickness, unless otherwise indicated.
 - 2. Galvanized Steel Sheet: ASTM A653, G60.
 - 3. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B456, Type SC 2.
 - 4. Galvanized Steel Mounting Devices: ASTM A153, hot-dip galvanized after fabrication.
 - 5. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.
 - 6. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply. Provide a minimum of 6 keys to the Owner's Project Manager.
 - 7. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.03 ACCESSORIES

- A. Toilet Accessories
 - 1. Grab Bars, 36" GB and 42" GB: Surface-mounted, 1-1/4 inches diameter, 36 inches and 42 inches where indicated, 18 gauge stainless steel, satin finish, as manufactured by Bobrick Washroom Equipment, Inc., "B-5806 Series", or approved equal.
 - 2. Coat Hook with Bumper, CH: Solid cast aluminum with matte finish hook and base, hard rubber bumper secured with drive-screw, as manufactured by Bobrick Washroom Equipment, Inc., "B-212", or approved equal.
 - 3. Toilet Tissue, Seat-Cover Dispenser, and Waste Disposal, TP/SCD: Recess-mounted, right side of toilet while seated, 22 gauge stainless steel, satin finish, as manufactured by Bobrick Washroom Equipment, Inc., "Classic Series, B-3092", or approved equal.

4. Mirror, MIR: Surface-mounted, glass mirror with stainless steel angle frame, satin finish, dimensions as indicated, as manufactured by Bobrick Washroom Equipment, Inc., "B-290 Series", or approved equal.
 5. Soap Dispenser, SDW: Wall-mounted, Type 304 stainless steel, satin finish, refillable, plastic container, capacity 800 ml, no-touch, sensor-activated valve suitable for foam soap, as manufactured by Bobrick Washroom Equipment, Inc., "B-2013", or approved equal.
 6. Paper Towel Dispenser and Waste Receptacle, PTD/WR: Recess-mounted, convertible, automatic, universal roll paper, stainless steel, satin finish, as manufactured by Bobrick Washroom Equipment, Inc., "ClassicSeries B-3974", or approved equal.
 7. Baby Changing Station, BBY: Surface-mounted, horizontal, 1-piece deep-drawn, uniform grain stainless steel components; Microban protection, liner dispenser, stainless steel bag hook, child protection straps; as manufactured by Koala Kare, "KB310-SSWM", or approved equal.
- B. Mounting Plates: Non-corrosive material. Provide as required.

2.04 FABRICATION

- A. General: Only a maximum 1-1/2 inch diameter, unobtrusive stamped manufacturer logo, as approved by the Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install toilet accessory units according to manufacturer's instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F446.
- D. Provide accessories as indicated on the Drawings.

3.02 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION

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SECTION 10 44 00**FIRE PROTECTION SPECIALTIES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Fire extinguishers complete with cabinets.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 09 90 00 - Painting and Coating: For finish painting.

1.02 REFERENCES

- A. NAAMM - National Association of Architectural Metal Manufacturers
 - 1. MFM - Metal Finishes Manual for Architectural Metal Products.
- B. SSPC - The Society for Protective Coatings
 - 1. SP 1 - Surface Preparation Specification No. 1: Solvent Cleaning.
 - 2. SP 5 - Surface Preparation Specification No. 5: White Metal Blast Cleaning.
 - 3. SP 8 - Surface Preparation Specification No. 8: Pickling.
- C. UL - Underwriters Laboratories Inc.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.
- B. Samples: Submit samples for initial selection purposes in the form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of cabinet finish indicated or exposed to view.
- C. Obtain Project Fire Inspector's approval of cabinet and extinguisher model prior to purchase.

1.04 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain extinguishers and cabinets from one source from a single manufacturer.
- B. UL Listed Products: Fire extinguishers shall be UL listed with UL listing mark for type, rating, and classification of extinguisher.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: Larsen's Manufacturing Co.; J. L. Industries, or approved equal.

2.02 MATERIALS

- A. Fire Extinguishers: Multipurpose under pressure, dry chemical type bearing UL rating of 2A-10B:C, 5 pounds nominal capacity, in enameled steel container.
- B. Cabinets
 - 1. Fully recessed, 1-piece steel construction with 18 gauge steel box; frame, door, and hardware to suit cabinet type and door style indicated; no glass panel; weld joints and grind smooth; miter and weld perimeter door frames.
 - 2. Provide reviewed manufacturer's stainless steel door handles.
 - 3. Door: Manufacturer's solid panel, trimless style.
- C. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER red lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
 - 1. Application Process: Silk screen.

2.03 FINISHES FOR CABINETS

- A. General
 - 1. Comply with NAAMM's MFM for recommendations relative to applying and designating finishes.
 - 2. Protect mechanical finishes on exposed surfaces from damage by applying temporary strippable protective covering prior to shipping.
- B. Steel Cabinet
 - 1. Surface Preparation: Solvent-clean surfaces complying with SSPC SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC SP 5 or SSPC SP 8.
 - 2. Finish: Factory-primed for field painting, as specified in Section 09 90 00.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine walls and partitions for thickness and framing for cabinets to verify cabinet depth and mounting prior to cabinet installation.
- B. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Follow manufacturer's printed instructions for installation.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights to comply with applicable regulations of governing authorities.
 - 1. Fasten mounting brackets and cabinets to structure, square and plumb.

END OF SECTION

SECTION 10 56 13**METAL STORAGE SHELVING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Cantilever type metal storage shelving.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 06 41 10 - Custom Casework: Provision of custom wood canopies and end panels.

1.02 REFERENCES

- A. ISO - International Organization for Standardization

1.03 SYSTEM DESCRIPTION

- A. Performance Requirement: Provide shelving capable of withstanding the effects of earthquake motions determined according to the building codes.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's data completely describing products.
- B. Shop Drawings: Show installation details for metal storage shelving, including upright-to-shelf/arm connections, lateral bracing, and attachments to other work. Include plans, elevations, sections, details, and relationship to other work.
- C. Samples: Submit standard samples for units and accessories with factory-applied color finishes.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: Basis of Design, Spacesaver Corporation, or approved equal.

2.02 MATERIALS

- A. Cantilever Shelving
 - 1. Seismic Welded Frame: Single-sided and double-sided shelves as indicated on the Drawings, height as indicated on the Stack Plan, 10 inches shelf, 12 inches base depth with closed base shelves; adjustable shelves with low back; with wall clips.
 - 2. Provide canopy bracket for wood veneer tops.
 - 3. Provide mounting brackets for wood veneer end panels.
- B. Custom Wood Canopies and End Panels: As specified in Section 06 41 10.

2.03 FINISHES

- A. Finishes shall be the finest of their respective kinds and those best adapted to the construction for which they are employed to meet ISO 9001:2000 quality standards. All steel shall be the best mild, cold rolled, pickled, and double annealed, free from scale and buckle. All plating used on exposed parts shall be metallic furniture stock. All gauges are U.S. standard. The design of all parts shall be such that the completed installation shall present a neat and finished appearance and shall be free from exposed sharp edges or projections. All other special materials shall be as hereinafter specified.
- B. All components shall be painted with an electrostatically applied powder coat finish. All steel parts shall be made smooth and thoroughly cleaned by a process of completely washing in a phosphatizing solution to ensure removal of oil, grease, or other foreign material which in any way would interfere with the adhesion of the priming coat. Following the cleaning process, all parts shall be coated by spraying, making certain every part is thoroughly and completely covered with fine powder coat, and baked to the paint manufacturer's recommendation. The finish for powder coat shall be medium gloss, giving a reading of 50 to 60 degrees on a standard gloss meter and must be capable of withstanding severe hammer and bending test without flaking. The finish for epoxy-polyester hybrid powder coat shall be a minimum 1.2 mil thickness capable of resisting acetic acid, household ammonia, 10 percent lye, alcohol, salt spray, abrasion and printing, and all normal usage resistant requirements of a good finish. In addition, powder coat shall not be off gassing to prevent deterioration of collection and other great value books.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine areas, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine floors for suitable conditions where metal storage shelving will be installed.
- C. Examine walls to which metal storage shelving will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Vacuum finished floor over which metal storage shelving is to be installed.

3.03 INSTALLATION

- A. Install metal storage shelving level, plumb, square, rigid, and true, and within erection tolerances specified.
 - 1. Anchor shelving units to floor with post installed expansion anchors or power-actuated fasteners through foot plate. Shim foot plate as required to achieve level and plumb installation.
 - 2. Install seismic supports and bracing as recommended by manufacturer and authorities having jurisdiction, and as required for stability. Extend and fasten members to supporting structure.
 - 3. Install shelves in each shelving unit at spacing indicated on Drawings.

- B. Erection Tolerances: Erect metal storage shelving with a maximum tolerance from vertical of 1/2-inch from 0 to 10 feet of height and remaining constant at a maximum of 1 inch for all heights taller than 10 feet.

3.04 ADJUSTING AND CLEANING

- A. Verify that shelves adjust easily and properly.
- B. On completion of installation, clean exposed surfaces as recommended by manufacturer.
- C. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.
- D. Replace metal storage shelving that has been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 11 31 00**RESIDENTIAL APPLIANCES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Installation of Owner furnished residential appliances.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 DELIVERY, STORAGE AND HANDLING

- A. Storage and Protection
 - 1. Deliver products to Project Site in manufacturer's undamaged protective containers, after spaces to receive them have been fully enclosed.
 - 2. Protect as required to prevent damage during construction.

PART 2 - PRODUCTS**2.01 APPLIANCES**

- A. Residential Appliances
 - 1. Microwave: As provided by the Owner.
 - 2. Under-Counter Refrigerator: As provided by the Owner.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine areas to receive equipment and verify that conditions are suitable and utility services and critical dimensions are correct.
- B. Do not install equipment until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General
 - 1. Comply with manufacturer's instructions and recommendations.
 - 2. Set units securely in place in accordance with manufacturer's recommendations.
 - 3. Conceal all fasteners.
- B. Built-In Equipment
 - 1. Securely anchor units to supporting casework or countertops with concealed fasteners.
 - 2. Verify that clearances are adequate for proper functioning, and rough openings are completely concealed.
- C. Free Standing Equipment
 - 1. Place units in final locations after finishes have been completed in each area.
 - 2. Verify that clearances are adequate for proper operation of equipment.
- D. Utilities: Refer to design-build drawings for plumbing and electrical requirements.

- E. Provide secondary lint trap with each washer/dryer combination. Refer to Mechanical Drawings.

3.03 ADJUSTING AND CLEANING

- A. Testing: Test each item of residential equipment to verify proper operation. Make necessary adjustments.
- B. Accessories: Verify that accessory items required have been furnished and installed.
- C. Cleaning: Remove pricing material and labels from residential equipment items and leave units in clean condition, ready for operation.

END OF SECTION

SECTION 11 51 16**BOOK DEPOSITORIES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Book return depository.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 REFERENCES

- A. ADA - Americans with Disabilities Act.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for book depository, including details of construction related materials, dimensions, profiles, component parts, accessories and finishes.
- B. Shop Drawings: Submit shop drawings from manufacturer for book depository, indicating layout, details, individual unit dimensions, required clearances, component parts, method of field assembly and anchorage to surrounding construction.
- C. Samples: Submit 6-inch by 6-inch samples of each exposed finish required.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturer: Kingsley Library Equipment, "#K-TWKD, KwikDrop Single ThruWall, Catalog #10-8951", or approved equal.

2.02 MATERIALS

- A. Book Depository Unit: ADA-compliant, weather-resistant, theft deterrent.
 - 1. Construction: Exterior facing, heavy-duty stainless steel faceplate with aircraft grade aluminum for interior chute and housing; AirBloc system eliminates drafts caused when the depository door is opened.
 - 2. Locking Method: Easy-to-operate KwikLock system allows locking and unlocking of the depository door with a simple push or pull knob.
 - 3. Dimensions
 - a. Overall: 20 inches wide by 17.25 inches deep by 13 inches high.
 - b. Depository Opening: 15 inches wide by 3.75 inches high.

2.03 FABRICATION

- A. General: Fabricate work in shop to greatest extent possible, before application of finishes. Remove sharp and rough edges and corners from cut metal and grind welds smooth. Design components, joints and connections to withstand most severe possible loading condition, with normal safety factor.

PART 3 - EXECUTION

3.01 BOOK DEPOSITORY INSTALLATION

- A. Install book depository unit in wall construction at location indicated, complying with manufacturer's recommended procedures and reviewed shop drawings.

3.02 ADJUST AND CLEAN

- A. Adjust units after installation to ensure that units are level and that moving parts operate freely and in manner intended. Clean exposed surfaces and touch-up or replace damaged marred finishes.

END OF SECTION

SECTION 12 36 61.16**SOLID SURFACING COUNTERTOPS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Solid surfacing countertop, SS-1.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Section 05 50 00 - Metal Fabrications: Provision of countertop supports.
 - 2. Section 06 41 10 - Custom Casework: Provision of custom casework.
 - 3. Section 07 92 00 - Joint Sealants: Provision of sealants.

1.02 REFERENCES

- A. WI - Woodwork Institute

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product literature.
- B. Shop Drawings: Show all items at large scale including methods of fabrication and construction.
- C. Samples: Submit 3 solid surfacing materials, 6 inches square.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturer: CaesarStone Quartz Surfaces,"Statuario Maximus 5031", or approved equal.

2.02 MATERIALS

- A. Solid Surfacing Material, SS-1: Homogeneous mixture containing 93 percent pure quartz with additions of high-performance polyester resin, pigments, and special effects.
 - 1. Thickness: 3 cm.
 - 2. Finish: Polished.
- B. Plywood Backing for Countertops: Provide 1/2-inch marine plywood or approved equal.
- C. Sealant: As specified in Section 07 92 00.

2.03 FABRICATION

- A. Quality Standard: Comply with WI Section 17D, "Decorative Synthetic Marble Countertops and Sinks".
 - 1. Grade: Premium.
 - 2. Thickness of solid surfacing shall be constant and shall not vary.

- B. Fabricate tops in 1 piece with shop-applied edges, unless otherwise indicated. Comply with solid surfacing material manufacturer's recommendations for adhesives, sealers, fabrication, and finishing.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Anchor countertops securely to base units and other support systems as indicated. Caulk space between countertop and wall with specified sealant.
 - 1. Install countertops with no more than 1/8-inch in 96 inch sag, bow, or other variation from a straight line.
- B. Seal joints in accordance with manufacturer's instructions.

3.02 ADJUSTING AND CLEANING

- A. Remove damaged or otherwise disfigured portions and replace with new prior to the Owner's acceptance.

END OF SECTION

SECTION 12 93 13**BICYCLE RACKS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Exterior bicycle rack.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 REFERENCES

- A. APBP - Association of Pedestrian and Bicycle Professionals

1.03 SUBMITTALS

- A. Product Data: Include physical characteristics such as shape, dimensions, parking capacity, and finish for each rack.
- B. Shop Drawings: Show installation details for each rack.
- C. Samples for Verification: Submit finish samples for review and verification.
- D. Maintenance Data: For each rack; include recommended methods for repairing damage to the finish.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing bicycle racks similar to those required for this project and with a record of successful in-service performance.
- B. Installer Qualifications: An experienced installer who has completed installation of bicycle racks 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.
- C. Mockups, General
 - 1. Mockups which are partially constructed or finished incorrectly will be rejected.
 - 2. Remove rejected mockups immediately from the Site.
 - 3. Place accepted mockups in a location where mockups can be referenced.
 - 4. Accepted mockups shall become the Project standard for tolerances and appearance.
 - 5. Coordinate with related trades to construct single integrated mockup as appropriate.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Upon delivery, before signing for shipment, inspect for any damages and notate on the Bill of Lading.
- B. Store racks in original undamaged packages and containers until ready for installation.
- C. Handle racks with sufficient care to prevent any scratches or damage to the finish.

1.06 WARRANTY

- A. Bicycle racks carry a 1-year manufacturer's limited warranty against defects in materials and workmanship. The warranty period begins the date the product is shipped from the manufacturer.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Accepted Manufacturer: Landscape Forms, Inc., "MultipliCITY Bike Rack", or approved equal.

2.02 BICYCLE RACK

- A. Bicycle rack constructed of cast aluminum; pre-finished anodized or powder-coated finish on aluminum; includes unfinished wood shelf; APBP guidelines.
 - 1. Color: As selected by the Architect.
 - 2. Wood Species: As selected by the Architect.
 - 3. Capacity: 2 bikes.
 - 4. Quantity: As indicated on the Drawings.
 - 5. Mounting: Surface-mounted or embedded, as indicated.
 - 6. Installation: Place 36 inches apart and 36 inches from wall.
- B. Installation Accessories: As required for installation method selected.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify gradients and elevations of substrate are correct.
- B. Verify that substrate is level, smooth, and capable of accepting racks.

3.02 INSTALLATION

- A. General
 - 1. Install units where indicated in accordance with manufacturer's recommendations for anchor mounting or in-ground mounting method as required.
 - 2. Drill holes to diameters indicated on shop drawings.
- B. Bicycle Rack
 - 1. Place bicycle rack in prepared holes. At multiple loop racks ensure lower U-bends are resting on the 1-1/2 inches high wood block.
 - 2. Pour in the cement and level the rack.
 - 3. Support the rack until cement is dry.
 - 4. Remove wood block.

END OF SECTION

SECTION 21 05 00**COMMON WORK RESULTS FOR FIRE SUPPRESSION****PART 1 GENERAL****1.1 SUMMARY**

- A. The intent of Division 21, Fire Suppression Specifications, and the accompanying Drawings is to be a reference for preliminary locations and routing of fire protection system components. Not all components required for a complete system are shown, including but not limited to standpipes, hose connections, sprinkler heads, fire protection zones, air compressors, dry valves, piping, appurtenances, connections, etc.
- B. Provide a complete and workable facility with complete systems that comply with the requirements of the state codes, local codes, fire marshal, owner's insurance underwriter, and any other authority having jurisdiction.
- C. Division 21, Fire Suppression Specifications and the accompanying Drawings are complimentary and what is called for by one as binding as if called for by both. Items shown on the Drawings are not necessarily included in the Specifications and vice versa.
- D. Imperative language is frequently used in Division 21, Fire Suppression Specifications. Except as otherwise specified, requirements expressed imperatively are to be performed by the Contractor.
- E. Piping and sprinkler head locations meet the Architectural design intent for the building in addition to applicable code. The right is reserved to make any reasonable changes in sprinkler head location prior to roughing-in, without cost impact. Deviation from the general routing piping mains, standpipes, or other routing shown must be approved by the architect prior to installation. If additional space is required for fire protection system components, Architect to make a formal request.
- F. Heat, heat trace, and associated power required for fire protection system components are the responsibility of the design-build contractor. Request approval from the electrical engineer to use spaces in electrical panels provided at no additional cost.
- G. Furnish piping, pipe fittings, valves, gauges, and incidental related items as required for complete systems. Identify valves, piping and equipment components to indicate their function and system served.
- H. The General and Supplemental Conditions apply to this Division, including but not limited to:
 - 1. Drawings and specifications.
 - 2. Public ordinances, permits.
 - 3. Include payments and fees required by governing authorities for work of this Division.
- I. Division 01, General Requirements, applies to this Division.

1.2 RELATED SECTIONS

- A. Section 21 10 00, Water Based Fire Suppression Systems

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Products and equipment prohibited from containing pentabrominated, octabrominated and decabrominated diphenyl ethers. Where products or equipment's within this specification contain these banned substances, provide complying products and equipment's from approved manufacturers with equal performance characteristics.
 - 2. General:
 - a. Conform Work and materials to requirements of the local and State codes, fire marshal, the owner's insurance underwriter, and any other authority having jurisdiction; and Federal, State and other applicable laws and regulations.

3. Contractor responsible for obtaining and payment for permits, licenses, and inspection certificates required in accordance with provisions of Contract Documents.
 4. Fire protection system designs must bear the stamp and seal of the registered Professional Engineer who prepared the documents. The Engineer's stamp certifies that the work was done under the Engineer's supervision and control. Certification from NICET technicians, or other contractors, cannot replace the certification by the Engineer. Verify/coordinate with local building department for their specific requirements.
- B. New materials and Equipment:
1. Good work quality, free of faults and defects and in conformance with the Contract Documents.
- C. Apparatus: Build and install to deliver full rated capacity at the efficiency for which it was designed.
- D. The entire system and apparatus operate at full capacity without objectionable noise or vibration.
- E. For remodel projects, the existing system must remain fully operational, or provisions made to provide coverage while the new system is being installed. New installation switchover requires minimal down time. Provide method to maintain fire protection or fire watch during any system down time. Include any related cost for materials or labor that is needed for providing continuous coverage.
- F. Install equipment level and true. Housekeeping pads and curbs account for floor or roof slope.
- G. Materials and Equipment:
1. Each piece of equipment furnished meet detailed requirements of the Drawings and Specifications and suitable for the installation shown. Equipment not meeting requirements will not be acceptable, even though specified by name along with other manufacturers.
 2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of same manufacturer.
 3. Furnish materials and equipment of size, make, type, and quality herein specified.
 4. Equipment scheduled by performance or model number is considered the basis of the design. If other specified manufacturer's equipment is provided in lieu of the basis of design equipment the contractor is responsible for changes and costs which may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements, or any other differences which impact the project.
- H. Workmanship:
1. General: Install materials in a neat and professional manner.
 2. Manufacturer's Instructions:
 - a. Follow manufacturer's directions where they cover points not specifically indicated. If they are in conflict with the Drawings and Division 21, Fire Suppression Specifications, obtain clarification before starting work.
- I. Cutting and Patching:
1. Cutting, patching, and repairing for the proper installation and completion of the work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting performed by skilled craftsmen of each respective trade in conformance with the appropriate Division of Work.

2. Make additional openings required in building construction by drilling or cutting. Use of jackhammer is specifically prohibited.
3. Fill holes which are cut oversize so that a tight fit is obtained around the sleeves passing through.
4. Do not pierce beams or columns without permission of Architect and then only as directed.
5. New or existing work cut or damaged restored to its original condition. Where alterations disturb lawns, paving, walks, etc., the surfaces repaired, refinished, and left in condition existing prior to commencement of work.

1.4 SUBMITTALS

A. Certified Shop Drawings:

1. Drawings indicate the general layout of the piping and various items of equipment. Coordination with other trades and with field conditions will be required.
 - a. Prepare fire protection system layout Drawings showing locations and types of head or outlets, alarm valves and devices, pipe sizes and cutting lengths, test tees and valves, drain valves, and other related items.
 - b. Prepare new drawings and not reproductions or tracings of Architect's Drawings.
 - c. Overlay drawings with shop drawings of other trades and check for conflicts.
 - d. Prepare Drawings at same size as Architect's Drawings with similar title block and identifying Architect's Drawing number or any reference drawings. Prepare in two-dimensional format.
 - e. Fully dimension including both plan and elevation dimensions.
 - f. Shop drawings cannot be used to make scope changes.
 - g. Include the following information and content within Shop Drawings:
 - 1) Sprinkler head layout drawings overlaid with ceiling and floor plans.
 - 2) Sprinkler floor plans, including piping, equipment, and heads to a minimum of 1/4-inch equals 1-foot scale or same as plans, whichever is greater.
 - 3) Superplot plans of above ground work with a colored overlay of all trades including, but not limited to, HVAC piping, HVAC equipment, plumbing piping and equipment, sprinklers, lighting, lighting controls, cable tray, fire alarm devices, electrical power conduit, and ceiling system to a minimum of 1/2-inch equals 1-foot scale.
 - 4) Beam penetration drawings indicating beam penetrations meeting the requirements indicated on the floor plans and on the structural drawings to a minimum of 1/4-inch equals 1-foot scale.
 - 5) Slab penetration drawings of HVAC, plumbing, sprinklers, lighting and electrical to a minimum of 1/4-inch equals 1-foot scale.
 - 6) Fabrication drawings of radiant ceiling panels, architectural metal ceiling, including panel penetrations for lighting, sprinkler heads, fire alarm devices, and any other penetrations.
2. Submit shop drawings for review prior to beginning fabrication. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field or when there is a question as to whether contract documents are being complied with or the design intent is being met.

B. Product Data:

1. Submit product data for review on scheduled pieces of equipment, on equipment requiring electrical connections or connections by other trades, and as required by each specification section or by Drawing notes. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures, and similar data. Manufacturer's abbreviations or codes are not acceptable
 2. Provide product data sheets of each type of sprinkler head.
 3. Indicate equipment operating weights including bases and weight distribution at support points.
 4. In the case of equipment such as wiring devices, time switches, valves, etc., specified by specific catalog number, a statement of conformance will suffice.
- C. Hydraulic Calculations:
1. Submit hydraulic calculations (specific to the installation) within the same package as the shop drawings. Shop drawings will not be reviewed without the associated hydraulic calculations.
- D. Test Reports:
1. Submit certificates of completion of tests and inspections.
- E. Submission Requirements:
1. Refer to Division 01, General Requirements for additional requirements related to submittals.
 2. Shop Drawings:
 - a. Provide electronic (PDF) set of Drawings showing sprinkler head locations and layout coordinated with architectural ceiling details to the Architect for review prior to submitting Drawings to insurance underwriter and Fire Marshal.
 - b. Provide electronic set Drawings and calculations to the Architect to be sent to the Owner's insurance underwriter for approval.
 - c. Re-submit electronic set of approved Drawings (with any previous comments incorporated) to Architect for final review prior to submitting to insurance underwriter and Fire Marshal.
 3. Product Data:
 - a. Submit electronic copies product data for Work of Division 21 in PDF format with each item filed under a folder (or electronically bookmarked) and labeled with its respective specification section number, article, paragraph, and mark, if applicable.
 - b. Include a complete index in the original submittal. Indicate both original items submitted and note any items that will be submitted at a later date to avoid delay in submitting.
 - c. Submit product data in a single submittal. Partial submittals will not be accepted. Re-submit any additional product information in the same format as the original. Upon receipt of the returned re-submittals, incorporate into a single submittal for close-out package.
- F. Contractor Responsibilities:
1. See that submittals are submitted at one time and are in proper order.
 2. Obtain approvals and permits from the AHJ.
 3. Ensure that equipment will fit in the space provided prior to purchase of equipment.
 4. Assure that deviations from Drawings and Specifications are specifically noted in the submittals. Failure to comply will void review automatically.

1.5 OPERATING AND MAINTENANCE MANUAL, PARTS LISTS, AND OWNERS INSTRUCTIONS

- A. Refer to Division 01, General Requirements for additional requirements.
- B. Submit final electronic package of manufacturer's operation and maintenance instruction manuals and parts lists for each piece of equipment or item requiring servicing. Submit data when the work is substantially complete, packaged separately, and clearly identified in durable 3-ring binder. Include name and contact information for location of source parts and service for each piece of equipment. Clearly mark and label in each submittal, the piece of equipment provided with the proper nameplate and model number identified. Provide wiring diagrams for electrically powered equipment.
- C. Instruct Owner thoroughly in proper operation of equipment and systems, in accordance with manufacturer's instruction manuals including all phases of control.
- D. **Furnish competent engineer knowledgeable in this building system for minimum of one 8-hour day to instruct Owner in operation and maintenance of systems and equipment. Keep a log of this instruction including dates, times, subjects, and those present and present such log when requested by Architect.**
- E. As required, provide fire pump as-constructed data, and installation, start-up and testing manuals.

1.6 AS-BUILT DRAWINGS

- A. Provide **3D model** and as-built drawings at the end of the project.
- B. 3D model in the following format:
 - 1. AutoCAD
 - 2. Revit
 - 3. **Navisworks**
- C. As-built drawings in PDF format.
 - 1. Drawings include the following:
 - a. Project specific title block.
 - b. Notations reflecting the as-built conditions of any additions to or variations from the construction documents provided as part of the BIM coordination, RFIs, ASIs, Owner Changes, and Field Coordination.

1.7 PROJECT CONDITIONS

- A. Existing Conditions: Prior to bidding, verify and become familiar with existing conditions by visiting the site, and include factors which may affect the execution of this Work. Include related costs in the initial bid proposal.
- B. Coordinate exact requirements governed by actual job conditions. Check information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.
- C. Coordinate shutdown and start-up of existing, temporary, and new systems and utilities. Notify Owner, City, and Utility Company.

1.8 WARRANTY

- A. Provide a written guaranty covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.
- B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of Owner acceptance of Work of this Division.
- C. Correct warranty items promptly upon notification.

1.9 PROVISIONS FOR LARGE EQUIPMENT

- A. Make provisions for the necessary openings in building to allow for admittance of equipment.

1.10 SUBSTITUTIONS

- A. Submit any requests for product substitutions in accordance with the Instructions to Bidders and the General and Supplemental Conditions.

PART 2 PRODUCTS

2.1 ACCESS PANELS

- A. Furnish under this Division as specified in another Division of work.

2.2 PIPE SLEEVES

- A. Interior Wall and Floor Sleeves:
 - 1. 18 gauge galvanized steel or another pre-approved water tight system.
- B. Interior Wall and Floor Sleeves (fire rated):
 - 1. Fire rated and water tight system approved by Authority Having Jurisdiction and Owners Insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size and service.
- C. Exterior Wall and On Grade Floor Sleeves:
 - 1. Cast Iron

2.3 FLOOR, WALL AND CEILING PLATES (ESCUTCHEONS)

- A. Furnish stamped split type plates as follows:
 - 1. Floor Plates:
 - a. Cast brass, chromium plated.
 - 2. Wall and Ceiling Plates:
 - a. Spun aluminum.

2.4 MACHINERY GUARDS

- A. Furnish guards for protection on rotating and moving parts of equipment. Provide guards for drives and motor pulleys, regardless of being enclosed in a metal cabinet.
- B. Design guards so as not to restrict air flow or heat transfer.
- C. Provide shaft holes in guards for easy use of tachometers at pulley centers. Guards easily removable for pulley adjustment or removal and changing of belts.
- D. Meet OSHA requirements including back plates.

2.5 ELECTRICAL EQUIPMENT

- A. General:
 - 1. Equipment and installed work as specified under Division 26, Electrical.
- B. Motors:
 - 1. Furnish as integral part of driven equipment. Drip-proof induction type with ball bearings unless noted otherwise.
 - 2. Built to NEMA Standards for the service intended.
 - 3. Rated for the voltage specified, suitable for operation within the range of 10 percent above to 10 percent below the specified voltage.
 - 4. Manufacturers:
 - a. Baldor
 - b. Westinghouse
 - c. General Electric

- d. Or approved equal.
- 5. Where provided, refer to Equipment Schedules on the Drawings for motor horsepower, voltage, and phase.
- 6. Refer to individual product sections for additional motor requirements.
- 7. Built-in thermal overload protection, or be protected externally with separate thermal overload devices with low voltage release or lockout. Hermetically sealed motors have quick trip devices.
- C. Starters:
 - 1. Provided under Division 26, Electrical, suitable for performing the control functions required, with the exception of self-contained equipment and where the starters are furnished as part of the control package.
- D. Equipment Wiring:
 - 1. Provide interconnecting wiring within or on a piece of fire suppression equipment with the equipment unless shown otherwise. This does not include the wiring of motors, starters and controllers provided under Division 26, Electrical.
- E. Control Wiring:
 - 1. Provide control wiring for fire suppression equipment.
- F. Codes:
 - 1. Provide electrical equipment and products with UL listing as required by governing codes and ordinances.

PART 3 EXECUTION

3.1 COORDINATION

- A. Coordinate fire protection piping and appurtenances with ducts, other piping, electrical conduit, and other equipment.
- B. Conceal fire protection piping and equipment be concealed except in area without ceilings and as noted on the Drawings.

3.2 GENERAL

- A. Install fire protection systems to serve the entire building.
- B. The drawings indicate approximate locations of piping, sprinkler zones, and types of systems. The drawings do not indicate the locations of sprinkler heads in ceiling areas. Locate sprinklers in the center of ceiling panels and symmetrically within rooms and down corridors, coordinated with and in pattern with lights and grilles. Deviations must be approved.
- C. Location of heads shown in ceiling areas may be changed if required by code requirements, but only after review by the Architect for new head locations for each specific instance.

3.3 SLEEVES

- A. Interior Floor and Wall Sleeves:
 - 1. Provide sleeves large enough to provide clearances around pipe outside diameter as required by NFPA. Penetrations through mechanical room and fan room floors made watertight by packing with safig insulation and sealing with Tremco Dymeric Sealant or approved water tight system.
- B. Sleeves through Rated Floors and Walls:
 - 1. Similar to interior sleeves except install fire-rated system approved by Authority Having Jurisdiction and Owner's Insurance Underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size and service.

- C. Exterior Wall Sleeves Below Grade:
 - 1. Large enough to allow for caulking and made watertight. Caulking from outside using link-seal modular wall and casing seal. Secure sleeves against displacement.
- D. On Grade Floor Sleeves:
 - 1. Same as below grade exterior wall sleeves, caulked from inside.
- E. Exterior Wall Sleeves Above Grade:
 - 1. Similar to interior wall sleeves except caulk outside with Tremco Dymeric Sealant.
- F. Layout work prior to concrete forming. Cut and patch as required. Reinforce sleeves to prevent collapse during forming and pouring.
- G. Floor sleeves maintain a water barrier by providing a water tight seal or extend 1-inch above finished floor except through mechanical equipment room floors and shafts where sleeves extend 2-inches above finished floor level. Sleeves through roof extend 8-inches above roof. Wall sleeves flush with face of wall unless otherwise indicated. Sleeves through planters extend 8-inches above planter base.
- H. Do not support pipes by resting pipe clamps on floor sleeves. Provide supplementary members so pipes are floor supported.
- I. Special sleeves detailed on the Drawings take precedence over this section.

3.4 FLOOR, WALL AND CEILING PLATES

- A. Install on piping passing through finished walls, floors, ceilings, partitions, and plaster furrings. Plates completely cover opening around pipe and duct.
- B. Secure wall and ceiling plates to pipe or structure.
- C. Plates not required in mechanical rooms or unfinished spaces.

3.5 CLEANING

- A. General:
 - 1. Clean equipment and piping of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Painted Surfaces:
 - 1. Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

3.6 EQUIPMENT PROTECTION

- A. Keep pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, equipment, and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated equipment, or apparatus to original conditions or replace at no cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.7 ACCESSIBILITY

- A. General:
 - 1. Locate valves, indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs, and removal or replacement conveniently and accessibly with reference to the finished building.
- B. Gauges:
 - 1. Install gauges so as to be easily read from the floors, platforms, and walkways.

3.8 PAINTING

- A. General:
 - 1. Coordinate painting of fire suppression equipment and items with products and methods in conformance with the appropriate Division of Work, Painting.
- B. Equipment Rooms and Finished Areas:
 - 1. Hangers, Miscellaneous Iron Work, Structural Steel Stands, Tanks, Equipment Bases, Steel valve bodies and bonnets:
 - a. One coat of black enamel.
 - 2. Equipment:
 - a. One coat of red machinery enamel. Do not paint nameplates.
 - 3. Sprinkler Heads:
 - a. Not painted.
- C. Concealed Spaces (above ceilings, not visible):
 - 1. Hangers, Miscellaneous Iron Work, Valve Bodies, and Bonnets: Not painted.
- D. Sprinkler Piping:
 - 1. Concealed from View: Not painted.
 - 2. Exposed to View: Paint pipe and hangers exposed to view, including in equipment spaces, with one coat approved rust inhibiting primer. Final finish coat as specified in conformance with the appropriate Division of Work, Painting.
 - 3. Exterior: Wire brush and apply two coats of rust-inhibiting primer and one coat of grey exterior machinery enamel. Final finish coat as specified in conformance with the appropriate Division of Work, Painting.
 - 4. Alarm Bell: Factory paint with two coats of red enamel.

3.9 ADJUSTING AND CLEANING

- A. General:
 - 1. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.
 - 2. Use particular care in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment as approved or replace with new equipment.
- B. Piping:
 - 1. Clean interior of piping before installation.
 - 2. Flush sediment out of piping systems.

3.10 ELECTRICAL EQUIPMENT

- A. Do not install fire suppression systems in switchgear rooms, transformer vaults, telephone rooms, or electric closets except as indicated.
- B. Fire Suppression systems not to pass over switchboards or electrical panelboards. Where conflicts exist, bring to attention of Architect.

END OF SECTION

SECTION 21 10 00
WATER BASED FIRE SUPPRESSION SYSTEMS**PART 1 GENERAL****1.1 SUMMARY**

A. This Section includes Design-Build work and the following:

1. Double Detector Check Assembly
2. Reduced Pressure Detector Assembly
3. Electric Alarm Bell
4. Fire Department Connection
5. Wet Standpipe Hose Valve
6. Standpipe Hose Valve Cabinet
7. Standpipe Roof Connection
8. Sprinkler Heads
9. Flow Switch
10. Tamper Switch
11. Fire Department Test Station
12. Valves
13. Air Vent
14. Ductile Iron Water Pipe
15. Black Steel Pipe
16. Flanged Joints
17. Mechanical Pipe Couplings and Fittings
18. Threaded Fittings
19. Expansion Loops/Seismic Expansion Joints
20. Pressure Gauges
21. Utility Markers
22. Valve Identification
23. Piping Markers
24. Equipment Identification

1.2 RELATED SECTIONS

1. Division 21 05 00 Common Work Results for Fire Suppression

1.3 QUALITY ASSURANCE

A. Provide a complete automatic fire sprinkler/combination standpipe system.

1. Grooved joint couplings, fittings, valves, and specialties products of a single manufacturer. Grooving tools of the same manufacturer as the grooved components.
2. Castings used for coupling housings, fittings, valve bodies, etc., date stamped for quality assurance and traceability.

B. Regulatory Requirements:

1. Sprinkler system to comply with NFPA 13 and local Fire Marshal requirements.
2. Refer to Section 21 05 00, Common Work Results for Fire Suppression for additional requirements.

- C. Hydraulically Calculated Sprinkler System: Sprinkler system to be hydraulically calculated grid system designed to provide:
 - 1. Light Hazard Occupancies: 0.10 GPM/Ft² density at most remote 1500 SF for public areas, living spaces, or designated by the local fire marshal with an excess of 10 psi additional pressure requirements incorporated into the design over specified pressure requirements or additional excess pressure as required by fire marshal.
 - 2. Ordinary Hazard Occupancies Group 1: 0.15 GPM/Ft² density at most remote 1500 SF for mechanical rooms, kitchen, and parking areas, or designated by the local fire marshal with an excess of 10 psi additional pressure requirements incorporated into the design over specified pressure requirements or additional excess pressure as required by fire marshal.
 - 3. Ordinary Hazard Occupancies Group 2: 0.20 GPM/Ft² density at most remote 1500 SF for mechanical rooms, kitchen, and parking areas, or designated by the local fire marshal with an excess of 10 psi additional pressure requirements incorporated into the design over specified pressure requirements or additional excess pressure as required by fire marshal.
- D. NFPA 13 (without the use of exceptions found in NFPA 13 systems minimum guideline) used for the location, sizing, and installation of piping and sprinkler systems unless local fire marshal or owner's insurance underwriter requirements are more stringent. Exceptions must be approved by the Engineer prior to usage.
- E. Water Service Pressure Basis of Design:
 - 1. Coordination was done to determine fire service water pressure used to develop the fire sprinkler system design information included herein.
 - 2. Obtain updated flow test information prior to starting their design of the fire sprinkler system.
- F. Automatic sprinklers within elevator hoistways and machine rooms complies with ANSI A17.1-102.2 (c) 4 requirements.

1.4 SUBMITTALS

- A. Provide submittal in accordance with Section 21 05 00, Common Work Results for Fire Suppression.
- B. Sprinklers referred to on shop drawings and identified by the listed manufacturer's style or series designation. Trade names and abbreviations are not permitted.

PART 2 PRODUCTS

2.1 SUMMARY

- A. This part provides accepted manufacturers and a description of relevant equipment used for a water based fire suppression system.
- B. Provide only new, first grade standard, current products of a manufacturer regularly engaged in the production of such materials and equipment. Where two or more pieces of equipment performing the same function are required, provide from same manufacturer.

2.2 MANUFACTURERS

- A. Detector Double Check:
 - 1. Ames
 - 2. Apollo/Conbraco
 - 3. Febco
 - 4. Watts
 - 5. Wilkins

6. Or as approved for use in the local jurisdiction and University of Southern California (USC) approval.
7. Other Manufacturers: Submit substitution request.
- B. Reduced Pressure Detector Assembly:
 1. Ames
 2. Apollo/Conbraco
 3. Febco
 4. Watts
 5. Wilkins
 6. Or as approved for use in the local jurisdiction and University of Southern California (USC) approval.
 7. Other Manufacturers: Submit substitution request.
- C. Electric Alarm Bell:
 1. Edwards Signaling
 2. Potter Electric Signal Company
- D. Fire Department Connection:
 1. Flush Type:
 - a. Elkhart
 - b. Potter-Roemer
 2. Siamese Double Clapper
 - a. Elkhart
 - b. FPPI
 - c. Potter-Roemer
- E. Standpipe Hose Valve:
 1. Elkhart
 2. FPPI
 3. Potter-Roemer
 4. Reliable
- F. Standpipe Hose Valve Cabinet
 1. Potter-Roemer
- G. Standpipe Roof Connection:
 1. Elkhart
 2. FPPI
 3. Potter-Roemer
- H. Sprinkler Heads:
 1. Globe
 2. Reliable Automatic Sprinkler
 3. Tyco Fire Protection Products
 4. Victaulic
 5. Viking
- I. Flow Switch:

1. Potter Electric
- J. Tamper Switch:
 1. Potter Electric Signal Company
- K. Fire Department Test Station:
 1. AGF
 2. Victaulic
- L. Valves:
 1. Where only one manufacturer's model is listed, equivalent products by those specified below, or equal, are acceptable upon approval.
 2. Use only one manufacturer.
 3. Gate:
 - a. Kennedy
 - b. Tyco Fire Products; TJP series, TJR series Models
 - c. Victaulic; 771, 772, 773 Model Series
 - d. Wilkins
 - e. Zurn
 4. Swing Check:
 - a. Kennedy; 1126, 1126A, 726 Models
 - b. NIBCO; G-997, W-403-W
 - c. Tyco Fire Products; CV-1F Model
 - d. Victaulic; 717 or 717H Model
 - e. Zurn/Wilkins; F210 Model
 5. Butterfly:
 - a. FPPI
 - b. Kennedy
 - c. Tyco Fire Protection Products
 - d. Victaulic
 - e. Zurn
 6. Specialty:
 - a. Conbraco
 - b. Kennedy
 - c. NIBCO
 - d. Victaulic
- M. Air Vents
 1. ECS
 2. Potter
 3. Reliable Automatic Sprinkler
 4. Tyco Fire Protection Products
- N. Ductile Iron Water Pipe:
 1. American
 2. McWane

- 3. US Pipe
- O. Black Steel Pipe:
 - 1. Bull Moose
 - 2. Wheatland
 - 3. Youngstown
- P. Flanged Joints:
 - 1. American
 - 2. Anvil
 - 3. McWane
 - 4. US Pipe
- Q. Mechanical Pipe Couplings and Fittings:
 - 1. Tyco Fire Protection Products/Grinnell
 - 2. Victaulic
- R. Mechanical Tee (allowed on renovation projects only)
 - 1. Tyco Fire Protection Products/Grinnell
 - 2. Victaulic
- S. Threaded Fittings
 - 1. American
 - 2. Anvil
 - 3. Tyco Fire Protection Products
 - 4. Viking
- T. Seismic Expansion Loops/Seismic Expansion Joints:
 - 1. Anvil
 - 2. Fireloop
 - 3. Metraflex Metraloop
- U. Pressure Gauges:
 - 1. Ametek
 - 2. Ashcroft
 - 3. FPPI
 - 4. Potter Roemer
 - 5. Reliable
 - 6. Victaulic
 - 7. Viking
 - 8. Winters Instruments
- V. Heat Trace Cable (Freeze Protection):
 - 1. Chromalox
 - 2. Raychem
 - 3. Other Manufacturers: Submit substitution request.
- W. Utility Markers:
 - 1. Brady Identoline

- 2. Seton
- X. Piping Markers:
 - 1. Marking Systems, Inc. (MSI).
 - 2. Seton
 - 3. W.H. Brady

2.3 DOUBLE CHECK DETECTOR ASSEMBLY

- A. 3-inch through 10-inch size with 3/4-inch bypass line, OS and Y type of shutoff valve with an auxiliary bypass line with an installed water meter. Main line check valve body and cover cast iron epoxy coated internally. Bypass line check valve body and cover bronze and check valve trim bronze, and four test cocks. UL listed and FM approved.

2.4 REDUCED PRESSURE DETECTOR ASSEMBLY

- A. 3-inch through 10-inch size with 3/4-inch bypass line, OS and Y type of shutoff valve with an auxiliary bypass line with an installed water meter. Main line check valve body and cover ductile iron epoxy coated internally, bronze main valve trim, bronze differential relief valve with stainless steel 316 trim and four test cocks. UL Listed or FM Approved.
- B. Maximum working pressure of 150 psi unless scheduled.

2.5 ELECTRIC ALARM BELL

- A. 10-inch diameter, 24VDC , 1-phase, red finish, UL listed or FM approved, labeled Fire Alarm.

2.6 FIRE DEPARTMENT CONNECTION (FDC)

- A. Description:
 - 1. Provide in accordance with California Fire Code and NFPA 13 and 14, Standard for Installation of Sprinkler Systems.
 - a. Install in an area accessible for the first response unit.
 - 2. Brass body with an integral clapper assembly to separate flow between inlets.
 - 3. UL listed or FM approved for fire protection use.
 - 4. At low point near each fire department connection, provide a 90-degree elbow with drain connection to allow for localized system drainage to prevent freezing.
- B. Flush Type: Polished **brass** plated flush fire department inlet connection with clappers, lettered (Auto. Spkr., OR Auto. Spkr. Standpipe) 4-inch by 2-1/2-inch by 2-1/2-inch complete with plugs and chains

2.7 STANDPIPE HOSE VALVE

- A. [2-1/2-inch by 2-1/2-inch] female x male hose valve with 1-1/2-inch reducer, cap and chain.

2.8 STANDPIPE HOSE VALVE CABINET

- A. 20-gauge steel box and frame in stainless steel, with glass door indicating "Fire Department Valve".
- B. Standpipe hose valves cabinets shall be fire rated where required.

2.9 STANDPIPE ROOF CONNECTION

- A. 2-way flush fire department connection, with back female inlet, 2-1/2-inch male outlets, and wall type hydrant control.

2.10 SPRINKLER HEADS

- A. General:
 - 1. Provide one manufacturer throughout building. Mixing of sprinkler brands is not permitted.

2. Brass frame construction with a coated metal sealing button coated with Teflon film. Sprinklers utilizing non-metal parts in the sealing portion of the sprinkler are strictly prohibited.
3. Quick response frangible bulb type fusible element with a temperature rating of 155 degrees or 200 degrees F or a fast response metal type fusible element with a temperature rating of 165 degrees or 212 degrees F
4. Standard spray and extended coverage to not be mixed within a space or compartment.
5. UL listed or FM approved for working water pressures up to 175 psi. Sprinkler heads in dry and preaction type systems installed per NFPA 13.
6. Heads, UL or FM approved for application and installation.
- B. Provide intermediate or high temperature heads for mechanical rooms, areas below skylights, dishwashing and other areas which have high heat producing equipment to prevent accidental tripping per NFPA requirements.
- C. Sprinklers Installed in Finished Ceilings:
 1. Quick response, recessed, bulb type, **chrome** finish, 165 degrees F unless required otherwise.
- D. Sprinklers Installed in Finished Ceilings:
 1. Quick response, concealed pendent with **chrome** drop-off cover plate, 155 degrees F unless required otherwise.
- E. Sprinklers Installed in Unfinished Ceiling Areas (or Above Finished Ceilings Where Required):
 1. Pendent or upright , rough bronze finish, and adequate temperature for the hazard.
- F. Sprinklers Installed in Exterior Perimeter Areas:
 1. Quick response, horizontal dry sidewall sprinkler, polished chrome finish.
- G. Sprinklers Installed in Exterior Covered Areas:
 1. Quick response, dry pendent , chrome finish, 165 degrees F unless required otherwise.
- H. Life Safety Type Sprinkler Heads (Window Wash to Maintain Ratings at Glazed Openings at Enclosed Stairs):
 1. Quick response, chrome finish, horizontal sidewall or pendent vertical sidewall, Central Model WS Window Sprinkler, or similar listed sprinkler for this application.
- I. Sprinkler Heads, Corrosion Resistant:
 1. Pendent type, rough bronze finish, 165 degrees F, with factory applied corrosion resistant coating.
- J. Flexible Stainless Steel Hose:
 1. UL listed, or FM approved stainless steel hose assembly for individual sprinkler connections.
 2. Drop includes a UL approved braided hose with a bend radius to 2-inch to allow for proper installation in confined spaces.
 3. Provide union joints for ease of installation.
 4. Attach flexible drop to the ceiling grid using a one-piece open gate bracket. The bracket allows installation before the ceiling tile is in place.
 5. The braided drop system is UL listed and FM approved for sprinkler services to 175 psi.

2.11 FLOW SWITCH

- A. Description:
 - 1. UL listed or FM approved electric flow switch with retard.
 - 2. Provide required accessories.
- B. Single pole type with normally open and normally closed contacts. Location as shown. Provide rewired related trimmings. Provide one set of contacts for use by the Fire Alarm Contractor. Coordinate with pipe size.

2.12 TAMPER SWITCH

- A. Description:
 - 1. Each sprinkler system control valve equipped with a tamper switch listed by Underwriters Laboratories for the particular location and type of valve supervised.
 - 2. Initiates a supervisory signal upon a maximum of two complete turns of a valve wheel or closure of ten percent, whichever is less.
 - 3. Provide number of poles to coordinate with the fire alarm system manufacturer.

2.13 FIRE DEPARTMENT TEST STATION

- A. One piece, compact, floor test module for standard alarm test loop, threaded.

2.14 VALVES

- A. Gate, butterfly, and check valves must be UL listed or FM approved.
- B. Bronze check valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- C. Full lug and grooved butterfly valves suitable for bi-directional dead end service at full rated pressure without use or need of a downstream flange.
- D. Gate Valves: Rising stem or Non-rising stem with Post Indicator type.
- E. Butterfly Valves: Extended necks.
- F. Valve ends may be threaded, flanged, or grooved as applicable to piping system.
- G. Provide ball drip drains, test orifices, and other related items as required to provide a complete fire protection system.
- H. Gate Valves:
 - 1. Bronze Gate: Bronze body, bronze screwed bonnet, bronze solid wedge, OS&Y pattern, rising stem, pre-grooved stem for supervisory switch mounting, 175 psi, UL listed or FM approved.
 - 2. Iron Gate: Iron body, OS&Y pattern, solid wedge, pre-grooved stem for supervisory switch mounting, 175 psi, UL listed or FM approved.
 - 3. Iron Gate, High Pressure: Iron body, OS&Y pattern, solid wedge, FM approved for 300 psi, UL listed 350 psi.
 - 4. Upright Post Indicating Valve Assembly: Non-rising stem Gate Valve and Post Indicator to be of same brand.
 - a. Non-rising Stem Gate Valve: Iron body, non-rising stem, solid wedge, 175 psi UL listed or FM approved.
 - b. Post-Indicator: Iron body, red epoxy, polycarbonate window, UL listed or FM approved.
- I. Check Valves:
 - 1. Horizontal Bronze Swing Check:
 - a. Bronze body, bronze-mounted, 175 psi.
 - b. Y-pattern, regrindable seat
 - c. Similar to Nibco KT-403-W

- d. UL listed or FM approved.
- 2. Horizontal Bronze Swing Check, High Pressure:
 - a. Bronze body, bronze-mounted, regrinding bronze disc, 365 psi.
 - b. UL listed or FM approved.
- 3. Swing Check:
 - a. Iron body, 175 psi
 - b. Can be installed vertically upward flow or horizontally
 - 1) Flanged valves may be horizontal only.
 - c. Non-slamming operation
 - d. Similar to Victaulic 717
 - e. UL listed or FM approved
- 4. Swing Check, High Pressure:
 - a. Iron body, 300 psi
 - b. Can be installed vertically for upward flow or horizontally
 - c. Non-slamming operation
 - d. Similar to Victaulic 717H
 - e. UL listed or FM approved
- J. Butterfly Valves:
 - 1. Iron Butterfly:
 - a. Ductile iron body, aluminum-bronze disc and one-piece stainless steel shaft, copper bushing, fasteners and pins not used to attach stem to disc, gear operator, stem neck length to accommodate insulation where applicable, EPDM liner or disc, 200 psi;).
 - b. Butterfly valves in main riser path, FM approved.
 - 2. Iron Butterfly, High Pressure: Ductile iron body, ductile iron disc and one-piece stainless steel shaft, copper bushings, fasteners and pins not used to attach stem to disc, with lever handle and locking feature on valves 6-inches and smaller, gear operator, EPDM liner or disc, 300 psi, integral supervisory switch, UL listed or FM approved.
- K. Specialty Valves:
 - 1. Drain Valves: Bronze ball valve, garden hose end, cap and chain 3/4-inch size, bronze cast body, chrome-plated full port ball, with handle, Teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, 600 psi CWP; NIBCO T-585-70-HC.
 - 2. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, 1/4-inch; Conbraco 41 series, or equal.

2.15 AUTOMATIC AIR VENT (MECHANICAL)

- A. The fire sprinkler contractor shall furnish and install an approved automatic air vent; 175 psi rated working pressure. Install per manufacturer's instructions.
- B. Provide at least one automatic air vent per automatic fire sprinkler system.
- C. Install automatic air vent at or near the remote high point of the fire protection system piping. Device location shall be at the location(s) provided on the drawings.
- D. The piping between fire protection system and automatic air vent must not create a water trap; the connecting piping must drain when fire protection system is drained or automatic air vent cannot perform venting functions.

- E. The fire sprinkler contractor shall leave the isolation ball valve in the open position after installation of the automatic air vent and the final testing of the system has been completed.
- F. The automatic air vent shall have redundant float valves to prevent leakage from the device in the event that the primary float valve fails; the automatic air vent shall not require plumbing to drain.
- G. The automatic air vent shall not require a drip pan or water collection device to prevent water discharge in the event that the primary float valve fails.
- H. The automatic air vent shall have a pressure indicating element indicating functionality of the primary float valve that is visible from the floor or below the device. The contractor shall install the automatic air vent in a location that provides a clear view of the pressure indicating element.
- I. Provide a supervised automatic air vent when automatic monitoring is specified.

2.16 DUCTILE IRON WATER PIPE

- A. Pipe: Ductile iron pipe conforming to ANSI A21.51.
- B. Fittings:
 - 1. Below grade, Class 150 Boltite mechanical joint type complete with gaskets, bolts, and nuts, or Tyton for joints employing a single gasket for the joint seal with bell-and-spigot pipe.
 - 2. Above grade, mechanical couplings and fittings as specified herein.
 - 3. Provide interior pipe coating per ANSI Regulation listed.
- C. Service: Below grade incoming fire protection main.

2.17 BLACK STEEL PIPE

- A. General:
 - 1. UL listed and FM approved for fire protection use.
 - 2. Fittings and joints must be UL listed with pipe chosen for use.
 - 3. Listing restrictions and installation procedures per NFPA 13 and state and local authorities for fire protection use.
 - 4. Pipe/fittings must be hot-dipped galvanized in accordance with ASTM A795 for dry pipe sprinkler systems if air filled.
- B. Pipe: ANSI/ASTM A53.
 - 1. Fire Protection:
 - a. Schedule 10 or Schedule 40 in sizes up to 5 inches.
 - b. 0.134-inch wall thickness for 6-inch.
 - c. 0.188-inch wall thickness for 8-inch and 10-inch.
 - d. 0.330-inch wall thickness for 12-inch.
- C. Grooved Fittings: Roll grooved ends with mechanical couplings as specified.
- D. Threaded Fittings: Threaded ends with fittings as specified.
- E. Mechanical tees using rubber gasketed fittings are permitted only when connecting to fire protection piping for additions or modifications to an existing system. Mechanical tees must use a connection method that completely wraps around the pipe.
- F. Service Above Grade: Fire protection system only for sizes listed, as approved by NFPA 13.

2.18 FLANGED JOINTS

- A. Flanged Joints:
 - 1. Cast iron or steel for screwed piping and forged steel welding neck for welded line sizes.

2. Pressure rating and drilling matches the apparatus, valve, or fitting to which they are attached.
3. Flanges in accordance with ANSI B16.1; 150 lb. for system pressures to 150 psi; 300 pounds for system pressures 150 psi to 400 psi.
4. Gaskets 1/16-inch thick, Cranite, or equal, ring type, coated with graphite and oil to facilitate making a tight joint.
5. Make joint using American Standard hexagon head bolts, lock washers, and nuts (per ASTM A307 GR.B) for service pressures to 150 psi; alloy steel stud bolts, lock washer, and American Standard hexagon head nuts (per ASTM A307 GR.B) for service pressures 150 psi to 400 psi. Use length of bolt required for full nut engagement.
6. Provide electro-cad plated bolts and nuts.

2.19 MECHANICAL PIPE COUPLINGS AND FITTINGS

A. Couplings and Fittings:

1. Coupling housing to be zero flex rigid type coupling with angled bolt pad design. Couplings fully installed at visual pad-to-pad offset contact. Couplings that require gapping of bolt pads or specific torque ratings for proper installation are not permitted. Installation-Ready, for direct stab installation without field disassembly. Similar to Victaulic Type 009N.
2. Flexible couplings to be used only when expansion contraction, deflection or noise and vibration is to be dampened. Flexible Coupling to be similar to Victaulic Installation-Ready Type 005. Coupling gasket similar to Victaulic's Grade E molded synthetic rubber per ASTM D-2000.
3. Coupling bolts oval neck track head type with hexagonal heavy nuts per ASTM A-449 and A-183.

2.20 MECHANICAL TEE

- A. UL listed or FM approved
- B. Only to be used on existing pipe to connect new pipe.
- C. Mechanical fittings that bite into the pipe shall not be used.
- D. Ductile iron body with carbon steel bolts and nuts to ASTM A-183. Similar to Victaulic 920 series.

2.21 THREADED FITTINGS

- A. Ductile iron conforming to ASME B16.3. Threads to be NPT per ANSI/ASME B1.20.1. Similar to Tyco Fire Protection Products Series 800.
- B. UL listed and FM approved.

2.22 SEISMIC EXPANSION LOOPS / SEISMIC EXPANSION JOINTS

- A. Flexible stainless steel hose and braid connector.
- B. Connector accepts differential support displacement without damaging pipe, equipment connections, or support connections.
- C. Materials of construction and pressure ratings appropriate for the application,
- D. UL listed and FM approved for fire protection use. Listing restrictions and installation procedures per NFPA 13 and state and local authorities for fire protection use.

2.23 PRESSURE GAUGES

- A. Description: 3-1/2-inch dial, turret case.
- B. Range:

SYSTEM	PRESSURE	GRADUATIONS

Wet	0-300 psi	5 psi
Dry	0-80 psi	2 psi
*Provide compound gauge where shown on inlet side of fire pump on open piping systems (30-inch 15 psi). Other ranges may be listed on Drawings in which case they take precedence.		

2.24 UTILITY MARKERS

- A. Provide plastic tape utility markers over buried piping. Provide identification on tape.
- B. Material to be Brady Identoline plastic tape, 6-inch, Seton, or as approved.

2.25 VALVE IDENTIFICATION

- A. Valve Tags:
 - 1. General:
 - a. Identify valves with metal tags or plastic signs, legends to be stamped or embossed.
 - b. Indicate the function of the valve and its normal operating position, and area served; i.e.

3RD FL	(Area Served)
ISOLATION	(Valve Function)
NO	(Normal Operation Position)
 - 2. Size: Valve tags 2-inch diameter with 1/4-inch high letters.
 - 3. Material: Use 0.050 or 0.064-inch brass tags.
 - 4. Control Valves:
 - a. Use 1/16-inch thick laminated 3-ply plastic, center ply white, outer ply red, lamicoid, or equal.
 - b. Form letters by exposing center ply.
- B. Valve Tag Directory: Include the following:
 - 1. Tag Number
 - 2. Location
 - 3. Exposed or Concealed
 - 4. Area Served
 - 5. Valve Size
 - 6. Valve Manufacturer
 - 7. Valve Model Number
 - 8. Normal Operating Position of Valve

2.26 PIPING MARKERS

- A. Label pipes with all-vinyl, self-sticking labels or letters.
- B. Pipe covering sizes up to and including 3/4-inch outside diameter, select labels with 1/2-inch letters. For sizes from 3/4 to 2-inch outside diameter, 3/4-inch letters; above 2-inches outside diameter, 2-inch letters.
- C. Identify and color code as follows with white directional arrows.

SERVICE	PIPE MARKER	BACKGROUND COLOR
SPRINKLER WATER	FIRE PROTECTION WATER	RED

2.27 EQUIPMENT IDENTIFICATION

- A. Nameplates:
 - 1. Tag pumps, and miscellaneous equipment with engraved nameplates.

2. 1/16-inch thick, 3-inch by 5-inch laminated 3-ply plastic, center ply white, outer ply black.
 3. Form letters by exposing center ply.
 4. Identify unit with code number as shown on Drawings and area served.
- B. Equipment Nameplate Directory:
1. List pumps, compressors and other equipment nameplates.
 2. Include Owner and Contractor furnished equipment.
 3. List nameplate designation, manufacturer's model number, location of equipment, area served or function, disconnect location, and normal position of HOA switch.

PART 3 EXECUTION

3.1 SUMMARY

- A. This part provides directions on installation of water based fire suppression systems.

3.2 INSTALLATION

- A. General:
1. Provide seismic hangers as required by code.
 2. Provide tamper switches on sprinkler system isolation valves. Provide flow switches for sprinkler zones. See Drawings for locations.
 3. A corrosion-resistant metal placard provided on riser indicating location number of sprinklers, design criteria, water demand, and date of installation.
 4. Install fire sprinklers in exhaust ductwork from grease hood per NFPA 13. Provide access doors for sprinkler access per NFPA 96 and IBC. Provide access doors at a maximum of 10-feet on center in horizontal run.
 5. Provide sprinkler systems in lab ductwork as required by code.
 6. Provide fire sprinkler guards on exposed sprinklers in areas subject to damage.
 7. Quick response sprinklers listed for installation in an Ordinary Hazard occupancy when installed in an Ordinary Hazard occupancy.
 8. All fire sprinkler system components shall be installed free of rust/corrosion or visible damage. All items not complying with this requirement shall be replaced without cost to the Owner.
 9. Provide an air vent at the high point of all of the fire protection systems as required by code and per the manufacture.
- B. Flexible Sprinkler Wet Head Drop:
1. Install per manufacturer's installation requirements.
 2. Coordinate head location with other trades to assure space is available to maintain proper radius requirements.
 3. Provide flexible sprinkler drops of appropriate length as conditions require.
 4. Provide flexible sprinkler drops at sprinkler heads located in suspended, dropped, or acoustical ceilings. In hard lid ceiling areas, provide flexible heads at Contractor's option.
- C. Sprinklers in Elevator Hoistways and Machine Rooms:
1. Reference Division 26, Electrical for heat detectors provided to disconnect mainline power of elevator prior to application of water from the sprinklers.
 2. A shutoff valve with tamper switch will be provided for each branch service serving these spaces and located in an accessible location outside these spaces.
- D. Sprinklers at Glazed Openings:

1. Where noted on Drawings, Glazed opening will be protected on both sides of glass by listed quick response Life Safety Type sprinkler heads designated to wet entire surface of glass. Sprinklers spaced 6-feet apart, 8- to 12-inches from the glass, or as required per sprinkler manufacturer's listed installation instructions.
- E. Sprinklers above finished ceilings: Include heads above finished ceilings if structure is combustible, or if steel beams are not provided with spray-on fire proofing.
- F. Electrical: Electrical work to comply with Division 26, Electrical.
- G. Fire Service: Connect to sprinkler line where it enters the building.
- H. Standpipe hose connections:
 1. Provide in locations indicated and as required by code.
 2. Confirm with the code official for hose connections that are at their discretion.
 3. Coordinate exact installation location of with the architect and code official.
- I. Hangers and Supports:
 1. Install sprinkler system hangers, and supports in accordance with NFPA 13.
 2. Install standpipe piping, hangers, and supports in accordance with NFPA 14.
 3. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- J. Pressure Gauges:
 1. Provide gauges where specified, shown on Drawings, or required by code.
 2. Install additional gauges as required and as recommended by equipment manufacturer or their representative.
 3. Locate gauges so that they may be conveniently read at eye level or easily viewed and read from the floor or from the most likely viewing area.
 4. Install instruments over 6-1/2-feet above floor, to be viewed from the floor, with face at 30 degrees to horizontal.
 5. Provide instrument gauge cock at inlets.
- K. Valves:
 1. Provide valves at connections to equipment where shown or required for equipment isolation.
 2. Install valves accessible and same size as connected piping.
 3. Provide separate support for valves where necessary.
 4. Provide drain valves in low points in the piping system, and at equipment, as required by code, and as indicated.
 5. Fire Suppression Service:
 - a. In piping 2-inches and smaller; bronze gate valve, bronze swing check valve, vertical check valve.
 - b. In piping 2-1/2-inches and larger; iron gate valve, iron swing check valve, vertical check valve.
 - c. UL listed and FM approved butterfly valves.
 - d. Non-slamming check valves on pump discharge.
 6. Provide gauge cocks for pressure gauges.
- L. Piping Preparation:
 1. Measurements, Lines and Levels:

- a. Check dimension at the building site and establish lines and levels for work specified in this Section.
 - b. Establish inverts, slopes, and elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with Drawings and Specifications.
 - c. Use established grid and area lines for locating trenches in relation to building and boundaries.
- M. Excavation and Backfill:
- 1. General:
 - a. Perform necessary excavation and backfill required for the installation of fire suppression work in accord with Division 02, Existing Conditions.
 - b. Repair pipelines or other work damaged during excavation and backfilling.
 - 2. Excavation:
 - a. Excavate trenches to the necessary depth and width, removing rocks, roots, and stumps.
 - b. Include additional excavation to facilitate utility crossovers, additional offsets, etc.
 - c. Excavation material is unclassified.
 - d. Width of trench adequate for proper installation of piping. Widen if not wide enough for a proper installation.
 - 3. Bedding:
 - a. Cast iron, steel, and copper piping fully bedded on sand.
 - b. Place a minimum 4-inch deep layer on the leveled trench bottom for this purpose.
 - c. Remove the sand to the necessary depth for piping bells and couplings to maintain contact of the pipe on the sand for its entire length.
 - d. Lay other piping on a smooth level trench bottom so that contact is made for its entire length.
 - 4. Backfill:
 - a. Place in layers not exceeding 8 inches deep and compact to 95 percent of standard proctor maximum density at optimum moisture content. Earth backfill free of rocks over 2 inches in diameter and foreign matter. Disposal of excess material as directed.
 - b. Interior: Backfill under interior slabs bank sand or pea gravel.
 - c. Exterior:
 - 1) Excavated material may be used outside of buildings
 - 2) First 4-inches of sand and final 12-inch layer of course soil.
- N. Piping:
- 1. Hold piping as tight to structure as possible. In general, run piping in areas without ceilings parallel to building elements in a neat, professional manner.
 - 2. Pipe inspector test connections to exterior and discharge as approved by local applicable governing authorities.
 - 3. Provide test tees as required.
 - 4. Install unions in non-flanged piping connections to apparatus and adjacent to screwed control valves, and appurtenances requiring removal for servicing so located that piping may be disconnected without disturbing the general system.

5. No fittings that bite into the pipe may be used.
6. Mechanical Couplings:
 - a. On systems using galvanized pipe and fittings, galvanize fittings at factory.
 - b. Before assembly of couplings, lightly coat pipe ends and outside of gaskets with approved lubricant.
 - c. Pipe grooving in accordance with manufacturer's specifications contained in latest published literature.
7. Install piping as to drain per NFPA 13.
8. Support piping independently at apparatus so that its weight not carried by the equipment.
9. Utility Marking:
 - a. Installed over the entire length of the underground piping utilities. Install plastic tape along both sides and the center line of the trenches at the elevation of approximately 12-inches above the top of utility.
10. Underground Water System:
 - a. Prior to testing pipe provide concrete thrust blocks at changes in direction.
 - b. Block size as required for types of fittings involved.
- O. Drain Piping:
 1. Pitch drain piping 1/2-inch per 10-feet minimum; no traps allowed.
 2. Discharge drain piping to outside with suitable splash plate to a location as approved by the architect.
- P. Piping Joints:
 1. Join pipe and fittings using methods and materials recommended by manufacturer in conformance with standard practice and applicable codes. Cleaning, cutting, reaming, grooving, etc. done with proper tools and equipment. Hacksaw pipe cutting prohibited. Peening of welds to stop leaks not permitted.
 2. Grooved Joints:
 - a. Install in accordance with the manufacturer's latest published installation instructions.
 - b. Clean pipe ends free from indentations, projections and roll marks in the area from pipe end to (and including) groove.
 - c. Gasket manufactured by the coupling manufacturer and verified as suitable for the intended service.
 - d. Factory trained representative (direct employee) of the coupling manufacturer to provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation.
 - e. Periodically visit the job site and review installation to ensure best practices in grooved joint installation are being followed.
 - f. Remove and replace any improperly installed products.
 3. No couplings installed in floor or wall sleeves.
 4. Steel Piping:
 - a. Screwed Joints:
 - 1) Pipes cut evenly with pipe cutter reamed to full inside diameter with burrs and cuttings removed.

- 2) Joints made up with suitable lubricant or Teflon tape applied to male threads only, leaving two threads bare.
 - 3) Joints tightened so that not more than two threads are left showing.
 - 4) Junctions between galvanized steel waste pipe and bell of cast iron pipe made with tapped spigot or half coupling on steel pipe to form spigot end and caulked.
 - b. Flanged Joints:
 - 1) Pressure rating of flanges match valve or fitting joined.
 - 2) Coat joint gaskets with graphite and oil.
5. Welded Joints:
 - a. Preparation for Welding: Bevel piping on both ends before welding:
 - 1) Use following weld spacing on butt welds:

NOMINAL PIPE WALL THICKNESS	SPACING	BEVEL
1/4-inch or less	1/8-inch	37-1/2
Over 1/4-inch, less than 3/4-inch	3/16-inch	27-1/2
 - 2) Before welding, remove corrosion products and foreign material from surfaces.
 - b. Welded Joints:
 - 1) Use arc-welding process using certified welders. Port openings of fittings must match the inside diameter of the pipe to which they are welded. Use full radius welding elbows for turns, use welding tees for tees. Use reducing fittings for size reduction. Weldolets may be used for branches up through one-half the pipe size of the main to which they are attached. Nipples are not allowed.
 - c. Welding Operation:
 - 1) After deposition, clean each layer of weld metal to remove slag and scale by wire brushing or grinding. Chip where necessary to prepare for proper deposition of next layer.
 - 2) Weld reinforcement no less than 1/16-inch not more than 1/8-inch above normal surface of jointed sections. Reinforcement crowned at center and taper on each side to surfaces being joined. Exposed surface of weld present professional appearance and be free of depressions below surface of jointed members.
 - 3) Do not weld when temperature of base metal is lower than 0 degrees F. Material to be welded during freezing temperatures made warm and dry before welding is started. Metal warm to the hand or approximately 60 degrees F.
6. Ductile Iron Pipe: Install joints per manufacturer's written instructions.
7. Mechanical Tee
 - a. Mechanical Tee only to join existing pipe to new pipe.
 - b. Cutting tool used to tap into existing pipe to be designed for use with specific model of Mechanical Tee.
 - c. Cutting remnant to be removed from pipe and hung from pipe
- Q. Seismic Expansion Loops / Seismic Expansion Joints:
 1. Install at building seismic expansion joints.
 2. Install in other locations indicated on the drawings.

3. Install per manufacturer's installation instructions.
- R. Pipe Wrap:
 1. Apply per manufacturer's written instructions.
 2. Apply wrapping to fittings in field after installation.

3.3 IDENTIFICATION

- A. Valve Identification:
 1. Valve Tags:
 - a. Attach to valve with a brass chain.
 - b. Valve tag numbers continuous throughout the building for each system. Obtain a list for each system involved from the Owner.
 2. Valve Tag Directory:
 - a. Include final copy in Operation and Maintenance Manual.
- B. Piping Markers:
 1. Unless recommendations of ANSI A13.1 are more stringent, apply labels or letters after completion of pipe cleaning, painting, or other similar work, as follows:
 - a. Every 20-feet along continuous exposed lines.
 - b. Every 10-feet along continuous concealed lines.
 - c. Adjacent to each valve and stub out for future.
 - d. Where pipe passes through a wall, into and out of concealed spaces.
 - e. On each riser.
 - f. On each leg of a T.
 - g. Locate conspicuously where visible.
 2. Apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above. Apply arrow labels indicating direction of flow. Arrows to be the same color and sizes as identification labels.
- C. Equipment Identification:
 1. Nameplates:
 - a. Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.
 2. Nameplate Directory:
 - a. Post final copy in Operation and Maintenance Manual.

3.4 EXTRA STOCK

- A. Provide additional number of heads of each type and temperature rating installed as required to meet NFPA 13 requirements.
- B. Provide storage cabinet or cabinets as required to receive reserve sprinkler heads and special installation tools required.
- C. Provide index label for each head indicating manufacturer, model, orifice size of K-factor, and temperature rating.
- D. Provide, inside cabinet a list of heads stored within and brief description of where installed.
- E. Locate cabinet near sprinkler control station as approved.

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:

1. Perform tests and arrange for required inspections of installed system as required.
 2. Notify the Architect 48 hours prior to any test or inspection.
 3. Provide final test and certification in the presence of an Owner representative.
Coordinate hereunder.
- B. Inspection Service:
1. At start of warranty year, execute inspection agreement.
 2. Without additional charge to Owner, make quarterly inspection of system during year.
 - a. Check and operate control valves.
 - b. Lubricate valve parts.
- C. Report each inspection to Owner.

END OF SECTION

SECTION 22 05 00**COMMON WORK RESULTS FOR 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 Section.
- B. The provisions of This Section, Common Work Results for Plumbing, apply to all sections in Division 22.
- C. All Sections of Division 22 are interrelated. When interpreting any direction, material, and method specified in any section of Division 22 consider it within the entirety of Work in Division 22.

1.2 SUMMARY

- A. The intent of Division 22 Specifications and the accompanying Drawings is to provide a complete and workable facility with complete systems as shown, specified and required by applicable codes. Include all work specified in Division 22 and shown on the accompanying Drawings, including appurtenances, connections, etc., in the finished job.
- B. The Division 22 Specifications and the accompanying Drawings are complimentary and what is called for by one shall be as binding as if called for by both. Items shown on the Drawings are not necessarily included in the Specifications and vice versa. Specifications shall supersede drawings in case of conflict.
- C. Imperative language is frequently used in Division 22 Specifications. Except as otherwise specified, requirements expressed imperatively are to be performed by the Contractor.
- D. The Drawings that accompany the Division 22 Specifications are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Offsets and transitions shall be assumed at a minimum at each duct crossing, structural penetrations through shear walls or beams, structural grids where ceiling heights are restricted, and at piping mains. Follow the Drawing as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the Building, subject to approval, and without additional cost to the Owner. The right is reserved to make any reasonable changes in fixture location prior to roughing-in, without cost impact.

1.3 RELATED WORK

- A. The General and Supplemental Conditions apply to this Division, including but not limited to:
 - 1. Drawings and specifications.
 - 2. Public ordinances, permits.
 - 3. Include payments and fees required by governing authorities for work of this Division.
- B. Division 1, General Requirements, applies to this Division.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. General: All work and materials shall conform to the local and State codes, and all Federal, State and other applicable laws and regulations.
 - 2. Contractor responsible for obtaining and payment for all permits, licenses, and inspection certificates required in accordance with provisions of Contract Documents.
- B. Materials and equipment shall be new. Work shall be of good quality, free of faults and defects and in conformance with the Contract Documents.
- C. Apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was designed.
- D. The entire plumbing system and apparatus shall operate at full capacity without objectionable noise or vibration.
- E. All equipment shall be installed level and true. Housekeeping pads and curbs shall account for floor or roof slope.
- F. Materials and Equipment:
 - 1. Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications and shall be suitable for the installation shown. Equipment not meeting all requirements will not be acceptable, even though specified by name along with other manufacturers.
 - 2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of same manufacturer.
 - 3. Furnish all materials and equipment of size, make, type, and quality herein specified.
 - 4. Equipment scheduled by performance or model number shall be considered the basis of the design. If other specified manufacturer's equipment is provided in lieu of the basis of design equipment the contractor is responsible for all changes and costs which may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements or any other differences which impact the project.
- G. Workmanship:
 - 1. General: All materials shall be installed in a neat and professional manner.
 - 2. Manufacturer's Instructions: Follow manufacturer's directions where they cover points not specifically indicated. If they are in conflict with the Drawings and Division 22 Specifications, obtain clarification before starting work.
- H. Cutting and Patching:
 - 1. Cutting, patching, and repairing for the proper installation and completion of the work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting shall be performed by skilled craftsmen of each respective trade in conformance with the appropriate Division of Work.
 - 2. Additional openings required in building construction shall be made by drilling or cutting. Use of jackhammer is specifically prohibited.
 - 3. Fill holes which are cut oversize so that a tight fit is obtained around the sleeves passing through.
 - 4. Beams or columns shall not be pierced without permission of Architect and then only as directed.
 - 5. All new or existing work cut or damaged shall be restored to its original condition. Where alterations disturb lawns, paving, walks, etc., the surfaces shall be repaired, refinished, and left in condition existing prior to commencement of work.

1.5 SUBMITTALS

- A. Product Data:
1. In general, submit product data for review on all scheduled pieces of equipment, on all equipment requiring electrical connections or connections by other trades, and as required by each specification section or by Drawing notes. Include manufacturer's detailed shop drawings, specifications and data sheets. Data sheets shall include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures, and similar data. Manufacturer's abbreviations or codes are not acceptable.
 2. List the name of the motor manufacturer and service factor for each piece of equipment.
 3. Indicate equipment operating weights including bases and weight distribution at support points.
 4. In the case of equipment such as wiring devices, time switches, valves, etc., specified by specific catalog number, a statement of conformance will suffice.
- B. Submission Requirements:
1. Shop Drawings and Product Data:
 - a. Refer to Division 1 for additional requirements related to submittals.
 - b. Submit copies of shop drawings and product data for Work of Division 22 in a 3-ring loose leaf binder with each item filed under a tab and labeled with its respective specification section number, article and paragraph, and mark if applicable.
 - c. Submit electronic copies of shop drawings and product data for Work of Division 22 in PDF format with each item filed under a folder and labeled with its respective specification section number, article, and paragraph and mark, if applicable.
 - d. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
 - e. The bulk of the shop drawings and product data, excepting Controls and Instrumentation, shall be included with the original submittal. Controls and Instrumentation submittals may lag but shall be complete when submitted. Partial submittals will not be accepted. Other stragglers submitted after return of the original binder shall include a tab similar to that originally submitted. Upon receipt of the returned late submittal, insert them in the previously submitted binder.
- C. Contractor Responsibilities: It shall be the Contractor's responsibility to:
1. See that all submittals are submitted at one time and are in proper order.
 2. Ensure that all equipment will fit in the space provided.
 3. Assure that all deviations from Drawings and Specifications are specifically noted in the submittals. Failure to comply will void review automatically.

1.6 OPERATING AND MAINTENANCE MANUAL, PARTS LISTS, AND OWNERS INSTRUCTIONS

- A. Refer to Division 1 for additional requirements.
- B. Instruct Owner thoroughly in proper operation of equipment and systems, in accordance with manufacturer's instruction manuals. Operating instructions shall cover all phases of control.

1.7 PROJECT CONDITIONS

- A. Existing Conditions: Prior to bidding, verify and become familiar with all existing conditions by visiting the site, and include all factors which may affect the execution of this Work. Include all related costs in the initial bid proposal.
- B. Coordinate exact requirements governed by actual job conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.

- C. Coordinate shutdown and start-up of existing, temporary, and new systems and utilities. Notify Owner, City and Utility Company.

1.8 WARRANTY

- A. Provide a written guaranty covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.
- B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of Owner acceptance of Work of this Division.
- C. Correct warranty items promptly upon notification.

1.9 TEST REPORTS AND CERTIFICATES

- A. Contractor shall submit one copy of all test reports and certificates specified herein to the Architect.

1.10 SUBSTITUTIONS

- A. Contractor shall submit any requests for product substitutions in accordance with the Instructions to Bidders and the General and Supplemental Conditions.

PART 2 - PRODUCTS

2.1 ACCESS PANELS

- A. Furnish under this Division as specified in another Division of work.

2.2 PIPE SLEEVES

- A. Interior Wall and Floor Sleeves: 18 gauge galvanized steel, or another pre-approved system.
- B. Interior Wall and Floor Sleeves (fire rated): Fire rated and water tight system approved by Authority Having Jurisdiction and Owners Insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size and service.
- C. Exterior Wall Sleeves: Cast iron.
- D. On Grade Floor Sleeves: Same as exterior wall sleeves.
- E. Water Tight Sleeves: Combination steel pipe sleeves with water stop and anchor plate; Link Seal Model WS, mated with synthetic rubber links interlocked with bolts and nuts; Link Seal Model LS.

2.3 FLOOR, WALL AND CEILING PLATES

- A. Furnish stamped split type plates as follows:
 - 1. Floor Plates: Cast brass, chromium plated.
 - 2. Wall and Ceiling Plates: Spun aluminum.

2.4 ELECTRICAL EQUIPMENT

- A. General: All equipment and installed work shall be as specified under Division 26, Electrical.
- B. Coordinate with the electrical Drawings and electrical contractor for minimum electrical equipment bracing requirements based on the available interrupting current (AIC) rating at the bus of the panelboard or switchboard serving the piece of equipment. Provide equipment that meets the bracing requirement.
- C. Equipment Wiring: Interconnecting wiring within or on a piece of mechanical equipment shall be provided with the equipment unless shown otherwise. This does not include the wiring of motors, starters and controllers provided under Division 26, Electrical.
- D. Control Wiring: All control wiring for plumbing equipment shall be provided herewith.
- E. Codes: All electrical equipment and products shall bear the Underwriters label as required by governing codes and ordinances.

PART 3 - EXECUTION

3.1 ACCESS PANELS

- A. Install in accord with manufacturer's recommendations, coordinated with architectural features.
- B. Provide 2-hour fire rated doors where required bearing the U.L. label.
- C. Furnish 18x18-inch panels for ceilings and for access to equipment in soffits and shafts, and 12x12-inch for walls unless indicated otherwise.
- D. Furnish where indicated and where required to access valves, trap primers, shock arresters, and other appurtenances requiring operation, service or maintenance. Submit proposed locations for review prior to installation.

3.2 SLEEVES

- A. Interior Floor and Wall Sleeves: Provide sleeves large enough to provide 3/4-inch clearances around pipe or ductwork. Where pipe or ductwork is insulated, insulation shall pass continuously through sleeve with 3/4-inch clearance between insulation and sleeve. Penetrations through mechanical room and fan room floors shall be made watertight by packing with safin insulation and sealing with Tremco Dymeric Sealant or approved system.
- B. Sleeves Through Rated Floors and Walls: Similar to interior sleeves except install fire rated system approved by Authority Having Jurisdiction and Owners insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size and service.
- C. Exterior Wall Sleeves Below Grade: Provide water tight sleeves. Install at pipes entering building below grade and where shown. Adjust to provide positive hydrostatic seal. Contractor shall be responsible for following manufacturer's procedure for installing and tightening seal. Secure sleeves against displacement.
- D. On Grade Floor Sleeves: Same as below grade exterior wall sleeves, caulked from inside.
- E. Exterior Wall Sleeves Above Grade: Similar to interior wall sleeves except caulk outside with Tremco Dymeric Sealant.

- F. Layout work prior to concrete forming. Do all cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.
- G. All floor sleeves shall maintain a water barrier by providing a water tight seal or they shall extend 1-inch above finished floor except through mechanical equipment room floors and shafts where sleeves shall extend 2 inches above finished floor level. Sleeves through roof shall extend 8 inches above roof. Wall sleeves shall be flush with face of wall unless otherwise indicated. Waste stacks using carriers shall have sleeves flush with floor and sealed. Sleeves through planters shall extend 8 inches above planter base.
- H. Do not support pipes by resting pipe clamps on floor sleeves. Supplementary members shall be provided so pipes are floor supported.
- I. Special sleeves detailed on drawings shall take precedence over this section.

3.3 CLEANING

- A. General: Clean plumbing equipment, fixtures and piping of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.
- C. Additional requirements are specified under specific Sections of this Division.

3.4 EQUIPMENT PROTECTION

- A. Keep pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment, or apparatus to original conditions or replace at no cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.5 ACCESSIBILITY

- A. General: Locate valves, thermometers, cleanout fittings and other indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs, and removal or replacement conveniently and accessibly with reference to the finished building.
- B. Thermometers and Gauges: Install thermometers and gauges so as to be easily read from the floors, platforms and walkways.

3.6 FLOOR, WALL AND CEILING PLATES

- A. Install on piping and ductwork passing through finished walls, floors, ceilings, partitions, and plaster furrings. Plates shall completely cover opening around pipe.
- B. Secure wall and ceiling plates to pipe, insulation, or structure.
- C. Plates shall not penetrate insulation vapor barriers.

- D. Plates not required in mechanical rooms or unfinished spaces.

3.7 PAINTING

- A. General: Coordinate painting of equipment and items with products and methods in conformance with the appropriate Division of Work, Painting. All exposed work under this division shall receive either a factory painted finish or a field prime coat finish, except:
1. Exposed copper piping.
 2. Aluminum jacketed outdoor insulated piping.
- B. Equipment Rooms and Finished Areas:
1. Insulation: Not painted.
 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Structural Steel Stands, Uninsulated Tanks, and Equipment Bases: Paint one coat of black enamel.
 3. Steel Valve Bodies and Bonnets: One coat of black enamel.
 4. Brass Valve Bodies: Not painted.
 5. Equipment: One coat of grey machinery enamel. Do not paint nameplates.
- C. Concealed Spaces (above ceilings, not visible):
1. Insulation: Not painted.
 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Valve Bodies and Bonnets: Not painted.

3.8 ADJUSTING AND CLEANING

- A. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.
- B. Use particular care in lubricating bearings to avoid damage by over lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment as approved or replace with new equipment.

3.9 ELECTRICAL EQUIPMENT

- A. Piping for plumbing systems not serving electrical space shall not be installed in any switchgear room, transformer vault, telephone room, or electric closet except as indicated.
- B. Piping for plumbing systems shall not pass over switchboards or electrical panelboards. Where conflicts exist, bring to attention of Architect.

3.10 EQUIPMENT CONNECTIONS

- A. Make final connections to equipment specified in sections other than Division 22 of the specifications and Owner furnished equipment in accordance with manufacturer's instructions and shop drawings furnished and as indicated.
- B. Piping:
1. Connections shall include hot and cold water, sanitary waste, and vent.
 2. Provide valves and specialties as specified and as detailed on the Drawings. Provide increasers, reducers, and any other fittings required for complete installation.
 3. All piping connections shall be independently supported to prevent undue strain on equipment.

END OF SECTION

SECTION 22 05 29**HANGERS, SUPPORTS AND ANCHORS FOR 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 Section.
- B. The provisions of Section 22 05 00, Common Work Results for Plumbing apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes: Supports and anchors for piping systems and equipment.

1.3 SUBMITTALS

- A. Submit the following:
 - 1. Shop Drawings of contractor fabricated piping support structures.
 - 2. No other submittals required under this section.

PART 2 - PRODUCTS**2.1 SUPPORTS, ANCHORAGE AND RESTRAINT**

- A. General: Provide pipe and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment, and supports and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor shall be responsible for their design.
 - 2. Seismic restraints and anchorages shall resist seismic forces as specified in the latest edition of the International Building Code for the seismic zone in which the project is constructed.
 - 3. Seismic restraint shall not introduce excessive stresses in the piping caused by thermal expansion or contraction.
 - 4. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
 - 5. Seismic restraints shall be in accordance with the latest edition of the SMACNA "Seismic Restraint Manual - Guidelines for Mechanical Systems" for the Seismic Hazard Level corresponding to the seismic zone in which the project is constructed.
 - 6. Seismic restraints shall be in accordance with the applicable code.
 - 7. Seismic restraints shall follow the provisions described in Section 22 05 48 Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Engineered Support Systems: The following support systems shall be designed, detailed, and bear the seal of a professional engineer registered in the State having jurisdiction.
 - 1. Supports and seismic restraints for suspended piping and equipment.
 - 2. Support frames such as pipe racks or stanchions for piping and equipment which provide support from below.
 - 3. Equipment and piping support frame anchorage to supporting slab or structure.

2.2 SUPPORTS, GENERAL

- A. Fabricate support members from welded standard structural shapes, pipe, and plate to carry the necessary rollers, hangers, and accessories as required. Support piping less than 4-inch pipe size from or by prefabricated roll-formed channels with necessary accessories to adequately support piping system.
- B. Acceptable Manufacturers: Unistrut, Superstrut, Powerstrut and Kinline, B-Line Systems, AnvilStrut.
- C. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.
- D. Dissimilar Metal Protection: Hydra-Zorb cushions or Cush-a-strip.
- E. Clamps: Super Strut Series 700 through 702 or AnvilStrut Series 1000 through 1200.

2.3 PIPE ATTACHMENTS

- A. Acceptable Manufacturers: Anvil as noted or equivalent products by Superstrut, B-Line Systems, Tolco, Michigan Hanger.
- B. Uninsulated Horizontal Copper Piping:
 - 1. 2-inch and Smaller: Anvil CT-65, CT-69, CT-99C.
 - 2. Larger than 2-inch: Anvil 260 field or factory copper plated, plastic coated or other recognized industry methods. Electricians' tape is unacceptable.
- C. Insulated Horizontal Copper Pipe with Hangers Inside of Insulation: Same as Uninsulated Horizontal Copper Pipe.
- D. Insulated Horizontal Copper Pipe with Hangers Outside of Insulation:
 - 1. 2-inch and Smaller: Anvil 65, 70, 104 or 260.
 - 2. Larger than 2-inch: Anvil 260.
- E. Other Uninsulated Horizontal Pipe:
 - 1. 2-inch and Smaller: Anvil 65, 70, 104 or 260.
 - 2. Larger than 2-inch: Anvil 260.
- F. Other Insulated Horizontal Pipe With Hangers Inside of Insulation:
 - 1. 2-inch and Smaller: Anvil 65, 70, 104, 260 or 300.
 - 2. Larger than 2-inch: Anvil 260.
- G. Other Insulated Horizontal Pipe with Hangers Outside of Insulation:
 - 1. 2-inch and Smaller: Anvil 65, 70, 104 or 260.
 - 2. Larger than 2-inch: Anvil 260.
- H. Riser Clamps Copper Pipe:
 - 1. 4-inch and Smaller: Anvil CT-121, CT-121C or 261C.
 - 2. Larger than 4-inch: Anvil 261C.
- I. Riser Clamps Other Piping: Anvil 261.

2.4 PIPE ROLLERS, INSULATION PROTECTION SHIELDS AND INSULATION PROTECTION SADDLES

- A. Acceptable Manufacturers: Anvil as noted or equivalent Super Strut, B-Line Systems, Tolco, Michigan Hangers.
- B. Pipe Rollers: Anvil 174 or 274 as required. Size for pipe plus insulation for insulated pipe.
- C. Insulation Protection Shields: Anvil 167.
- D. Insulation Protection Saddles: Anvil 160 through 166A as required. Saddles for copper pipe, factory or field copper plated.

2.5 BUILDING ATTACHMENTS

- A. Acceptable Manufacturers: Anvil as listed or equivalent products by Elcen, Superstrut, B-Line Systems, Tolco, Michigan Hangers.
- B. Beam Hangers:
 - 1. On piping 6-inch and smaller: Anvil 86 with retaining clip Fig. 89.
 - 2. On piping larger than 6-inch: Anvil 228, or 292.
- C. Inserts: Anvil 152 malleable iron or 281 steel inserts. Inserts sized for required rod to support load being carried.
- D. Expansion Plugs: Similar and equal to Phillips "red-head" self-drilling flush shell selected for safety factor of 4.
- E. Powder actuated fasteners with silencers as approved by Architect.

PART 3 - EXECUTION

3.1 HANGERS AND SUPPORTS

- A. General:
 - 1. Install all support systems as detailed and in accordance with manufacturer's recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required and as detailed on the Drawings.
 - 2. Provide adjustable hangers for all pipes complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., except where specified otherwise.
 - 3. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping and do not support piping from other piping.
 - 4. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
 - 5. Install all cast iron piping in accordance with Cast Iron Soil Pipe Industry (CISPI) Standards.
 - 6. Support all piping within 2 feet of each change of direction on both sides of fitting.
- B. Insulated Piping Systems:
 - 1. See Section 22 07 00 for insulation requirements.
 - 2. Insulated Piping Systems with Vapor Barrier Insulation:
 - a. Install hangers outside of insulation.
 - b. On piping 1-1/2-inch and larger, provide insulation protection shields at each support location.

3. Insulated Piping Systems with Non-Vapor Barrier Insulation:
 - a. As specified for Insulated Piping Systems with Vapor Barrier Insulation.
 4. Insulation Protection:
 - a. Band insulation protection shields firmly to insulation to prevent slippage.
 - b. Tack weld insulation protection saddles to steel pipe. Braze saddles to copper pipe.
- C. Vertical Piping:
1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
 2. Riser clamps on steel pipe to be directly welded to pipe. Riser clamps on copper pipe to be installed directly under fitting.
 3. Risers that are not subject to thermal change to be supported at each floor of penetration.
 4. Risers that are subject to thermal change require engineered supports. Size supports to carry all forces exerted by piping system when in operation. Riser supports shall follow the provisions described in Section 22 05 48, Vibration and Seismic Controls for Plumbing Piping and Equipment.
- D. Horizontal Piping:
1. Trapeze Hangers: Multiple pipe runs where indicated shall be supported on channels with rust resistant finish. Provide all necessary rods and supporting steel.
 2. Support Spacing: Provide support at minimum spacing per MSS SP-69-1996 Pipe Hangers and Supports - Selection and Application:
 - a. Support piping within 2 feet of each change in direction.
 - b. Fuel Gas Piping: Support in accordance with local code requirements.
 - c. Plumbing Piping: Support in accordance with local plumbing code.
 - d. Plastic Pipe: Supported a maximum of 3 feet on center for piping 1-inch and smaller and 4 feet on center for piping 1-1/4-inch and larger with rod sizes as recommended by the manufacturer.
 - e. Piping provided with acoustical lagging wrap shall be supported a maximum of 5 feet on center. Install hangers outside of acoustical lagging.
- E. Building Attachments:
1. Fastening or attaching to steel deck (without concrete fill) is prohibited. It will be necessary to support all piping from structural members, beams, joists, or provide intermediate angle iron supporting members between joists. Supports may be attached to concrete filled steel deck with load limitations shown on the structural drawings or otherwise obtained from the structural engineer.
 2. Provide horizontal bracing on all horizontal runs 1-1/2 inch and larger and exceeding 50 feet in length at 75 foot intervals and as required to provide stabilized piping systems.
 3. Provide all additional structural steel angles, channels, or other members required to support piping where structures do not occur as required for proper support.
 4. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points.

END OF SECTION

SECTION 22 05 48**VIBRATION AND SEISMIC CONTROLS FOR PLUMBING 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 1 Specification Sections, apply to this Section.
- B. The provisions of Section 22 05 00, Common Work Results for Plumbing apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes:
 - 1. Isolation of mechanical equipment as indicated on the Drawings and specified herein.
 - 2. Seismic restraint of equipment and piping.
- B. Related Sections include:
 - 1. Section 22 05 29 Hangers, Supports and Anchors for Plumbing.

1.3 QUALITY ASSURANCE

- A. A single manufacturer shall select and furnish all isolation required, except packaged equipment with integral isolators meeting all the isolation and seismic requirements of this specification.
- B. Isolation performance requirements are indicated on the Drawings. All deflections indicated are nominal static deflections for specific equipment supported.
- C. Isolator Stability and Rated Capacity:
 - 1. Spring diameters not less than 0.8 of the compressed height of the spring at rated load.
 - 2. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.
- D. Seismic Restraints:
 - 1. Restraint of equipment and piping to be in accordance with the current state and local Building Code.
 - 2. All calculations shall be in accordance with current state and local Building Code.

1.4 SUBMITTALS

- A. Submit the following:
 - 1. Submit product data and calculation sheets for isolators, showing:
 - a. Size, type, load rating and rated deflection of each required isolator.
 - b. Percent of vibration transmitted based on the lowest disturbing frequency of the equipment.
- B. Installation report as specified in Part 3 of this section.
- C. Operation and maintenance data.

1.5 EQUIPMENT VIBRATION ISOLATION

- A. Provide a balanced set of vibration isolators for each piece of equipment listed in the Equipment Schedules.
- B. Isolation work to include, but not necessarily be limited to, the following:
 - 1. Isolation support of motor-driven equipment.
 - 2. Inertia base frames in conjunction with isolation.
 - 3. Isolation support of piping and piping risers.
 - 4. Penetration isolation of pipework and conduits through walls, floors or ceilings.
 - 5. Flexible connections of piping to equipment.
- C. Each piece of rotating equipment must meet a reasonable criterion for maximum vibration levels at each bearing, while in operation. The criteria for varying operating speeds are given as follows:
 - 1. Rotating equipment operating peak vibration velocities must not exceed 0.08 in./sec.
 - 2. If it is discovered that the operating vibration velocities exceed this criteria, the equipment shall be repaired or replaced at no expense to the owner until approval of the equipment is given by the engineer.
- D. Any components or materials not specially mentioned herein, but necessary to the proper vibration isolation of the equipment, shall be provided.

1.6 ACCEPTABLE MANUFACTURERS

- A. Mason Industries, Inc.
- B. Kinetics Corporation.
- C. Vibrex.
- D. Approved equal, meeting all of the conditions and requirements specified herein.

1.7 CONTRACTOR RESPONSIBILITY

- A. All vibration isolation devices, including auxiliary steel bases and pouring forms, shall be designed and furnished by a single manufacturer or suppliers.
- B. Adequately restrain all equipment and piping to resist seismic forces. Design and select restraint devices to meet seismic requirements as defined in the latest issue of the International Building Code under Earthquake Design and applicable state and local codes.
- C. In addition, the contractor shall have the following responsibilities:
 - 1. Selection, installation, adjustment and performance of vibration isolators which will meet the requirements given on the plans or in the specifications.
 - 2. Provide Engineering drawings, details, supervision, and instruction to assure proper installation and performance.
 - 3. Provide whatever assistance necessary to ensure correct installation and adjustment of the isolators.

PART 2 - PRODUCTS**2.1 NEOPRENE WAFFLE PAD**

- A. 3/4-inch thick neoprene waffle pads with pattern repeating on 1/2-inch centers.
- B. Select Duro rating for maximum deflection at average load rating.
- C. Include load distribution steel plate as required.
- D. Include anchor bolt grommet as required.
- E. Acceptable Manufacturer: Mason Type "Super W" or "Super WM" and "HG Grommet"; Similar Amber-Booth, Kinetics Corporation.

2.2 RESTRAINED NEOPRENE MOUNT

- A. Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2-inches and all directional seismic capability.
- B. The mount shall consist of a ductile iron casting containing two separated and opposing molded neoprene elements.
- C. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation.
- D. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications.
- E. Manufacturer: Mason type BR.

2.3 ISOLATING SPRING HANGERS

- A. Combination rubber-in shear and steel spring isolators installed on the hanger rods.
- B. Isolators shall have the proper deflection to allow the piping to deflect as a unit with the pump isolators.
- C. Hangers designed for 30 degree angular movement.
- D. Minimum deflection shall be one inch.
- E. Manufacturer: Mason 30N, similar Amber-Booth, Consolidated Kinetics, Vibrex.

2.4 ISOLATING NEOPRENE HANGERS

- A. Double deflection neoprene hangers shall have a minimum static deflection of 0.35-inches.
- B. Provide projecting bushing to prevent steel to steel contact.
- C. Manufacturer: Mason HD, similar Amber-Booth, Consolidated Kinetics, Vibrex.

2.5 ISOLATING SLEEVES

- A. Provided for all piping through walls and floors of penthouses and chiller room. Size for piping as required.
- B. Manufacturers: Potter-Roemer PR isolators or Grinnell Semco Trisolators.

2.6 SEISMIC RESTRAINTS

- A. General Requirements:
1. Seismic restraints shall be provided for all equipment and piping, both supported and suspended.
 2. Bracing of piping shall be in accordance with the code and with the provisions set forth in the SMACNA seismic restraint manual.
 3. The structural requirements for the restraints, including their attachment to the building structure, shall be reviewed and approved by the structural engineer.
 4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.
- B. Supported Equipment:
1. All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene.
 2. Bushing shall be replaceable and a minimum of 1/4-inch thick. Rated loadings shall not exceed 1000 psi.
 3. An air gap of 1/4-inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces.
 4. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to ensure no short circuits exist before systems are activated.
 5. Snubber shall be type Z-1225 as manufactured by Mason Industries, Inc.
- C. Bracing of Pipes:
1. Provide seismic bracing of all piping as detailed below to meet the building code requirements:
 - a. Exception: Piping suspended by individual hanger's 12-inches or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached, need not be braced where the following criteria are met.
 - 1) Seismic braces are not required on high deformability piping when the $I_p=1.0$ and provisions are made to avoid impact with larger pipe or mechanical components or to protect the pipe in the event of such impact and the nominal pipe size is 3-inches diameter or less.
 - 2) Seismic braces are not required on high deformability piping when the $I_p=1.5$ and provisions are made to avoid impact with larger pipe or mechanical components or to protect the pipe in the event of such impact and the nominal pipe size is 1-inch diameter or less.
 2. Seismic braces for pipes on trapeze hangers may be used.
 3. Provide flexibility in joints where pipes pass through building seismic joints or expansion joints, or where pipes connect to equipment.
 4. Cast iron pipe of all types, glass pipe, and any other pipe jointed with a shield and clamp assembly, where the top of the pipe is 12-inches or more from the supporting structure, shall be braced on each side of a change in direction of 90 degrees or more. Riser joints on unsupported sections of piping shall be braced or stabilized between floors.
 5. Vertical risers shall be laterally supported with a riser clamp at each floor. For buildings greater than six stories high or for piping subject to thermal change all risers shall be engineered individually.
- D. Suspended Equipment and Piping:
1. Seismic cable restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint.
 2. Cable must be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement.

3. Cable assemblies shall be type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod and the clevis or SCBV if clamped to a beam, all as manufactured by Mason Industries, Inc.
4. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall be type SRC or UC as manufactured by Mason Industries, Inc.
5. Pipe clevis cross-bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross brace shall be type CCB as manufactured by Mason Industries, Inc.

2.7 FLEXIBLE SPHERE CONNECTOR

- A. Flexible EPDM pipe connectors shall be manufactured of multiple plies of Kevlar tire cord fabric and EPDM; both molded and cured in hydraulic rubber presses. No steel wire or rings shall be used as pressure reinforcement.
- B. Connectors up to and including 2-inch diameter may have a single sphere and threaded ends. Connectors 2-1/2-inch and larger shall be manufactured with twin spheres up to 12-inches and a single sphere on larger sizes and floating steel flanges recessed to lock the connectors raised face EPDM flanges.
- C. All connectors shall be rated a minimum of 150 psi at 220°F. All connections shall be pre-extended as recommended by the manufacturer to prevent additional elongation under pressure.
- D. Mason type SFU, SFDEJ or SFEJ.

2.8 FLEXIBLE HOSE CONNECTOR

- A. Flexible stainless steel hoses shall be manufactured using type 304 stainless steel hose and braid with one fixed and one floating raised face carbon steel plate flange.
- B. Sizes 2-1/2-inch (65mm) and smaller may have threaded male nipples or copper sweat ends. Grooved ends are acceptable in all sizes in grooved piping systems. Weld ends are not acceptable. Copper sweat end hoses for water service shall be all copper or bronze construction.
- C. Hose shall have close pitch annular corrugations for maximum flexibility and low stiffness. Tested hose stiffness at various pressures must be included in the submittals.
- D. Hose shall be capable of continuous operation at 150 psi and system test pressure when installed in piping systems.
- E. Hose shall be the same size as the pipe it connects and have pipe thread connectors on both ends with male or female end adapters as required.
- F. Mason type BSS, FFL, MN, CPS or CPSB, similar HCl, Metraflex.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not install any equipment or pipe which makes rigid contact with the building. "Building" includes slabs, beams, studs, walls, etc.
- B. The installation or use of vibration isolators must not cause any change of position of equipment or piping which would result in stresses in piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. The load shall not be transferred to the isolator until the installation is complete and under full operational load.
- C. Correct, at no additional cost, all installations which are defective in workmanship or materials.

3.2 PREPARATION

- A. Treat all isolators, including springs, hardware and housing, with a corrosion protective coating of epoxy powder or electro galvanizing.
- B. Coat steel frames exposed to weather with a rustproof metal primer.
- C. Provide hot dipped galvanizing on steel frames as indicated on the plans for corrosion protection in severe conditions.

3.3 INSTALLATION

- A. General:
 - 1. Install isolation where indicated on the Drawings by type and location and where indicated below.
 - 2. The assigned code number shall be marked on the isolators and bases to assure placement in the proper location.
 - 3. Anchor isolator seismic housing baseplate to floor.
 - 4. Rubber grommets and washers shall be provided to isolate the bolt from the building structure. Under no circumstances shall the isolation efficiency be destroyed when bolting the isolators to the building structure.

3.4 SEISMIC RESTRAINTS

- A. General:
 - 1. Install and adjust seismic restraints so that the equipment and piping support is not degraded by the restraints.
 - 2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.
- B. Supported Equipment:
 - 1. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.
 - 2. Care must be taken so that the 1/4-inch air gap in the seismic restraint snubber is preserved on all sides in order that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.
- C. Bracing of Pipes:
 - 1. Branch lines may not be used to brace main lines.
 - 2. Transverse bracing shall be at 40 feet maximum, except where a lesser spacing is indicated in the SMACNA tables for bracing of pipes

3. Longitudinal bracing shall be at 80 feet maximum except where a lesser spacing is indicated in the tables. In pipes where thermal expansion is a consideration, an anchor point may be used as the specified longitudinal brace provided that it has a capacity to resist both the seismic load and the additional force induced by expansion and contraction.
 4. A rigid piping system shall not be braced to dissimilar parts of the building or to two dissimilar building systems that may respond differently during an earthquake.
 5. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section of the same size connected perpendicular to it if the bracing is installed within 24 inches of the elbow or tee.
 6. Subject to confirmation by field inspection, seismic bracing is not required on piping when the piping is supported by rod hangers and the hangers in the entire run are 12-inches or less in length from the top of the pipe to the supporting structure, hangers are detailed to avoid bending of the hangers and their attachments and provisions are made for piping to accommodate expected deflections.
- D. Suspended Equipment, Piping, Cable Method:
1. The cables shall be adjusted to a degree of slackness approved by the Structural Engineer.
 2. The uplift and downward restraint nuts and Mason type RW neoprene covered steel rebound washers for the Type 6 hangers shall be adjusted so that there is a maximum 1/4-inch clearance.

3.5 FIELD QUALITY CONTROL

- A. Installation Report: Isolation manufacturer's representative shall confirm that all isolation is installed correctly and submit report stating that isolators are installed as shown on Shop Drawings, isolators are free to work properly, and that installed deflections are as scheduled and as specified.

END OF SECTION

SECTION 22 05 53**IDENTIFICATION FOR PLUMBING 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 1 Specification Sections, apply to this Section.
- B. The provisions of Section 22 05 00, Common Work Results for Plumbing apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes: Identify valves, piping and equipment components of the mechanical systems to indicate their function and system served.

1.3 SUBMITTALS

- A. Submit the following:
 - 1. Valve Tag Directory: Submit for approval prior to fabrication of valve tags.
 - 2. Equipment Nameplate Directory: Submit for approval prior to fabrication.
 - 3. Operating and Maintenance Data: Include a copy of valve tag and equipment nameplate directories in each set of Operating and Maintenance manuals.

PART 2 - PRODUCTS**2.1 VALVE IDENTIFICATION**

- A. Valve Tags:
 - 1. General: Identify valves with metal tags, legends to be stamped or embossed. It shall indicate the function of the valve and its normal operating position; i.e.,
56 HW (NUMBER AND CONTENT OF PIPE)
ISOLATION (VALVE FUNCTION)
NO (NORMAL OPERATION POSITION)
 - 2. Size: Valve tags 2-inch diameter with 1/4-inch high letters.
 - 3. Material: Use 0.050 or 0.064-inch brass tags.
 - 4. Automatic Valves and Regulating Valves: Use 1/16-inch thick laminated 3-ply plastic, center ply white, outer ply red, "lamicoid" or equal. Form letters by exposing center ply.
 - 5. Buildings Systems: Contact the Owner for coordination with existing building tagging system and supplementary information required for any specific system before valve tagging begins.
- B. Valve Tag Directory: Include tag number, location, exposed or concealed, service, valve size, valve manufacturer, valve model number, and normal operating position of valve.

2.2 PIPING MARKERS

- A. Acceptable Manufacturers:
 - 1. W.H. Brady, Seton, Marking Systems, Inc. (MSI).

2. Other Manufacturers: Submit Substitution Request.
- B. Pipes shall be labeled with all-vinyl, self-sticking labels or letters. For pipe covering sizes up to and including 3/4-inch outside diameter, select labels with 1/2-inch letters. For sizes from 3/4 to 2-inch outside diameter, 3/4-inch letters; above 2-inches outside diameter, 2-inch letters. The pipe markers shall be identified and color coded as follows with black directional arrows.

PLUMBING SERVICE	BACKGROUND PIPE MARKER *	COLOR
COLD WATER	"DOMESTIC COLD WATER"	GREEN
HOT WATER	"DOMESTIC HOT WATER SUPPLY"	YELLOW
	"DOM. HOT WATER RECIRC"	YELLOW OR GREEN
SANITARY WASTE	"SANITARY WASTE"	GREEN
VENT	"VENT"	GREEN

* Directional arrow applied adjacent to pipe marker indicating direction of flow.

** Provide custom marker labels for all piping for which no standard manufactured marker is available. Submit sample for approval.

2.3 EQUIPMENT IDENTIFICATION

- A. Nameplates:
- Tag all pumps, converters, and miscellaneous items of mechanical equipment with engraved nameplates. Nameplates shall be 1/16-inch thick, 3 x 5 laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
 - Identify unit with code number as shown on Drawings and area served.
- B. Equipment Nameplate Directory: List pumps, and other equipment nameplates. Include Owner and Contractor furnished equipment. List nameplate designation, manufacturer's model number, location of equipment, area served or function, disconnect location, and normal position of HOA switch.

PART 3 - EXECUTION

3.1 VALVE IDENTIFICATION

- A. Valve Tags:
- Attach to valve with a brass chain.
 - Valve tag numbers shall be continuous throughout the building for each system. Contractor shall obtain a list for each system involved from the engineer.
- B. Valve Tag Directory: Post final copy in Operation and Maintenance Manual.

3.2 PIPING MARKERS

- A. Unless recommendations of ANSI A13.1, 1981 are more stringent, apply labels or letters after completion of pipe cleaning, insulation, painting, or other similar work, as follows:
- Every 20 feet along continuous exposed lines.
 - Every 10 feet along continuous concealed lines.
 - Adjacent to each valve and stubout for future.

4. Where pipe passes through a wall, into and out of concealed spaces.
 5. On each riser.
 6. On each leg of a "T".
 7. Locate conspicuously where visible.
 8. Provide pipe identification (over insulation) for all reclaimed water systems in accordance with current local codes and rulings.
- B. Further, apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above. Apply arrow labels indicating direction of flow. Arrows to be the same color and sizes as identification labels.
- C. Install tags on specialty gas piping valves with brass chain.

3.3 EQUIPMENT IDENTIFICATION

- A. Nameplates: Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.
- B. Nameplate Directory: Post final copy in Operation and Maintenance Manual.

END OF SECTION

SECTION 22 07 00**INSULATION FOR 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 Section.
- B. The provisions of Section 22 05 00, Common Work Results for Plumbing apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes: Insulation for piping, and equipment.
- B. Related Sections include:
 - 1. Section 22 05 29 Hangers, Supports and Anchors for Plumbing.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Flame and Smoke Ratings: Installed composite flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by UL 723.
 - 2. Energy Codes: Local Building and Energy Codes shall govern where insulation performance requirements for thickness exceeds thickness specified.
- B. Protection: Protect against dirt, water, chemical, or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost.
- C. Source Quality Control:
 - 1. Service: Use insulation specifically manufactured for service specified.
 - 2. Labeling: Insulation labeled or stamped with brand name and number.
 - 3. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, shall not react corrosively with equipment, piping, or ductwork, and shall be asbestos free.

1.4 SUBMITTALS

- A. Submit the following.
 - 1. Product Data: For each type including density, conductivity, thickness, jacket, vapor barrier, and flame spread and smoke developed indices.

PART 2 - PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. Equivalent products by Johns Manville, Knauf, Owens Corning, and CertainTeed are acceptable.

- B. All such insulation shall be of one manufacturer.
- C. Other Manufacturers: Submit Substitution Request.

2.2 PIPE INSULATION

- A. Pre-formed mineral wool: Mineral wool insulation made from basalt, volcanic rock, and bound with thermosetting resin; ASTM C447; ASTM C547; ASTM C585; ASTM C795; ASTM E84; ASTM C1335; ASTM C1338; UL 723. Johns Manville MINWOOL-1200 or equal.

2.3 PIPE ACOUSTICAL WRAP

- A. Barrier shall be constructed of a 0.10-inch thick mass loaded, limp vinyl sheet bonded to a layer of reinforced aluminum foil on one side. The barrier shall have a nominal density of 1 lb per square foot and minimum STC rating of 28. The barrier shall have a minimum thermal conductivity value of 0.29 and a rated service temperature range of -40°F to 220°F. Barrier shall have a flame spread index of no more than 10 and a smoke development index of less than 40.
- B. The decoupling layer shall be a combination of 1-inch fiberglass batting, non woven porous scrim-coated glass cloth, quilted together in a matrix of 4-inch diamond stitch pattern which encapsulates the glass fibers. The composite material shall be fabricated to include a nominal 6-inch wide barrier overlap tab extending beyond the quilted fiber glass to facilitate a leak-tight seal around field joints.
- C. Kinectics Noise Control model KNM-100ALQ.

2.4 BLOCK INSULATION

- A. Fiberglass: 1-1/2-inch thick unless specified or shown otherwise with 3 pcf nominal density, 0.23 per inch maximum K-factor at 75°F mean temperature and 450°F minimum operating temperature limit. Johns Manville 1000 Series.

2.5 ACCESSORIES PIPING

- A. Adhesives:
 - 1. Fiberglass: Zeston Z-Glu.
- B. Cements:
 - 1. Insulating: Ryder.
 - 2. Heat Transfer: Zeston Z-20.
- C. Wire Mesh: 1-inch mesh with 20 gauge annealed steel wire.
- D. Pipe Fitting Covers: Aluminum
- E. Grooved Coupling Insulation: One piece PVC insulated fitting cover, Zeston, Ceel-Co.
- F. Metal Pipe Jacket: 0.016-inch thick aluminum jacket with formed fitting covers, aluminum snap straps and sealant.
- G. Cloth Facing: Presized fiberglass cloth.
- H. Tapes: Pressure sensitive, weather resistant, and for temperatures up to 150°F. Zeston Z-tape.

- I. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the PVC fitting covers, elastomeric, aluminum facing, Kraft paper, tapes and adhesives.

PART 3 - EXECUTION

3.1 GENERAL

- A. Workmanship:
1. Installation: Insulation installed in first class, neat professional manner.
 2. Applicators: Applicators shall be employed by firm that specializes in insulation work.
- B. Preparation: Surfaces of piping and equipment clean, free of oil or dirt, and dry before insulation is applied.
- C. Stamps: ASME stamps, UL labels, and similar stamps and labels shall not be covered.

3.2 PLUMBING PIPE AND EQUIPMENT INSULATION APPLIED LOCATIONS

- A. Insulation Applied Locations – Plumbing Piping:

System	Pipe Size	Insulation Type	Insulation Thickness	Notes
Domestic Cold Water, Above Grade	1 1/4-inch and smaller	Fiberglass, all purpose jacket or Elastomeric or Polyolefin	1-inch	Note 1 Note 2
	Above 1 1/4-inch	Fiberglass, all purpose jacket	1 1/2-inch	Note 1
Domestic Hot Water Supply/Return, Above Grade	1 1/2-inch and smaller	Fiberglass, all purpose jacket or Elastomeric or Polyolefin	1 1/2-inch	Note 1 Note 2
	Above 1 1/2-inch	Fiberglass, all purpose jacket	2-inch	Note 1
Traps and trap priming lines (In unheated Spaces)	All	Fiberglass, all purpose jacket	1-inch	Insulate over heat tape
Note 1: Cover with metal pipe jacket where exposed to weather, and over heat trace cable. Note 2: Elastomeric or polyolefin insulation not allowed over heat trace cable.				

- B. The following piping is not insulated:
1. Waste and vent, except where heat traced.
 2. Domestic cold water runouts to single fixture less than 12-inch long and exposed supplies.
- C. Insulation shall include all fittings, unions, flanges, mechanical couplings, valve bodies, valve bonnets, piping through sleeves, except valve bonnets, unions and flanges need not be insulated on the following systems: Domestic hot water, inside building.

- D. Valves and irregular fittings shall be insulated with section of pipe insulation and insulating cement, securely fastened, and finished with 6 oz. canvas and Foster 30-36 lagging adhesive. The contractor shall have the option on all flanges, valves, strainers, not requiring a vapor barrier to insulate with removable replaceable pads fabricated of 1-inch layer of Pittsburgh Corning Temp Mat sandwiched between inner and outer layer of 8 oz. glass cloth held together with stainless staples with sufficient stainless lacing hooks to hold pad firmly to flange or valve with minimum 3-inch overlap onto adjacent pipe insulation using 18 gauge S.S. lacing wire.
- E. Expansion Joints and Flexible Connectors: Pipe insulation or block of same material and thickness as adjacent piping.

3.3 PIPING INSTALLATION

- A. General:
 - 1. Joints: Coat both sides of complete joining area with applicable adhesive.
 - a. Longitudinal Joints: Make joints on top or back of pipe to minimize visibility. Except foam plastic, seal with closure system or 3-inch wide tape.
 - b. Butt Joints: Butt lightly together and, except for foam plastic, seal with 3-inch wide tape or butt straps.
 - c. Multiple Layered Insulation: Joints staggered.
 - 2. Access: Strainer and other items requiring service or maintenance with easily removable and replaceable section of insulation to provide access.
 - 3. Voids: Fill all voids, chipped corners and other openings with insulating cement or material compatible with insulating material. In insulation with Heat Tracing: Where piping is shown or specified to be heat traced, bed heat tape into heat transfer cement with insulation over heat tape and cement.
 - 4. Seal joints, seams and fittings of metal watertight jackets at exterior locations.
- B. Fiberglass Insulation: Exterior insulation encased in metal jacket.
- C. Calcium Silicate Insulation:
 - 1. Secure with 18-gauge wire embedded into insulation.
 - 2. Cover with continuous vapor barrier jacket.
- D. Elastomeric and Polyolefin Insulation:
 - 1. Slit full length and snap around pipe.
 - 2. Make cuts perpendicular to insulating surface leaving no cut section exposed.
 - 3. Do not stretch insulation to cover joints or fittings.
 - 4. Seal joints in elastomeric insulation with adhesive.
 - 5. Seal joints in polyolefin as specified hereinbefore.
 - 6. Exterior insulation painted with two coats of specified paint in accordance with the manufacturer's instructions and encase in metal jacket.
 - 7. Sealing joints with tape will not be allowed.
- E. Fittings: Insulation specified with continuous vapor barrier, the vapor barrier must not be violated.
 - 1. On Elastomeric and Polyolefin Insulation: Fittings covered with covers made up of mitered sections of insulation or with formed pipe fitting covers.
 - 2. In Other Insulation: Fittings covered with insulation to the same level of the adjoining insulation or fill with insulating cement. Finish with pipe fitting covers or cloth facing and tape.
- F. Unions, Mechanical Joints, Valves, Etc.:
 - 1. General:
 - a. As specified for fittings.
 - b. Minimum thickness same as specified for piping.

2. Unions: Build up insulation at least 1/2-inch beyond adjoining insulation.
 3. Flanges: With square corners. Where flanges are not insulated, terminate adjacent insulation so flange bolts can be removed.
 4. Flanged Valves: Insulation with square corners.
- G. Vapor Barrier Insulation:
1. Refer to Section 22 05 29 for support requirements.
 2. Piping which requires vapor barrier protection shall have a continuous vapor barrier, which may not be pierced or broken. The following piping systems require vapor barrier protection:
 - a. Domestic cold water.
 - b. Industrial cold water.
 - c. Non-potable cold water.
 - d. All other piping systems with a nominal operating temperature below 65°F.
 3. Vapor Barrier Insulation:
 - a. Insulation for pipe requiring vapor barrier protection 1-1/4-inch or smaller, insulation continuous through pipe hangers and rollers.
 - b. For pipe 1-1/2-inch and larger, 18-inch section of calcium silicate, same thickness as pipe insulation with continuous vapor barrier jacket at each hanger or roller. Provide pipe shield specified in Section 22 05 29.
- H. Non-Vapor Barrier Insulation:
1. Refer to Section 22 05 29 for support requirements.
 2. For pipe 1-1/4-inch or smaller, insulation continuous through pipe hangers and rollers.
 3. For pipe 1-1/2-inch and larger, 18-inch section of calcium silicate, same thickness as pipe insulation. Provide pipe shield specified in Section 22 05 29.
- I. Acoustical Wrap:
1. Install in accordance with the manufacturer's instructions.
 2. Applied locations for piping systems:
 - a. Where specified or indicated on drawings.

3.4 EQUIPMENT INSTALLATION

- A. General: Install true and smooth. Insulation over curved surfaces shall conform to curves of surface.
1. Access: Insulated removable heads, water boxes, pump casings, access, etc., that require service, inspection or maintenance shall be provided with covers or section that are easily removable and replaceable. Reinforce openings in adjacent insulation with metal beading. In vapor barriered insulation, coat joints with vapor barrier mastic.
 2. Voids, Depressions and Cavities: All voids, chipped corners and other openings shall be filled with insulating cement or material compatible with insulating material.
 3. Vapor Barriered Insulation: Where insulation is specified to have a vapor barrier, the barrier shall not be pierced or broken.
 - a. Tears, etc., shall be coated with vapor barrier mastic and patched with insulation facing or tape.
 - b. Staples brush coated with vapor barrier coating.
 - c. All raw edges coated with vapor barrier mastic shall be covered and cover shall be sealed to equipment surface.
 4. Non-Vapor Barriered Insulation:
 - a. Tears, etc., shall be patched with insulation facing or tape.
 - b. All raw edges shall be covered and neatly beveled to the equipment surface.
 5. Multilayered Insulation: With staggered joints.
- B. Fiberglass Block:
1. Anchors: Lug nuts 10 gauge black annealed iron wire welded to metal surfaces.

2. Banding: Block secured to surface with 1/2-inch wide stainless steel bands maximum 18-inches on center and secured to anchors.
3. Insulating Cement: Block covered with insulating cement minimum thickness of 1/2-inch with smooth finish.
4. Vapor Barrired System: On vapor barrired system, apply continuous coat of vapor barrier mastic.
5. Finish: Finish with cloth facing secured with adhesive and lapped a minimum of 2 inches. Defects touched up with finishing cement.

3.5 FIELD QUALITY CONTROL

- A. Field Test: All systems shall be tested and approved prior to installation of insulation.
- B. Existing Insulation:
 1. Repair existing insulation damaged during construction.
 2. Make neat connections where new and existing insulation meet.
 3. Where existing piping, or equipment is removed, cover existing surfaces neatly to match existing.

END OF SECTION

SECTION 22 21 13**PIPE AND PIPE FITTINGS 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 Section.
- B. The provisions of Section 22 05 00, Common Work Results for Plumbing apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes: Furnish piping, pipe fittings, and incidental related items as required for complete piping systems.
- B. Related Sections Include:
 - 1. Section 22 25 00 Plumbing Water Treatment.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Piping material and installation to meet requirements of the local plumbing, fire, and building codes and serving utility requirements.
 - 2. Provide chlorination of domestic cold and hot water piping in accordance with County and State health requirements.
- B. All grooved joint couplings and fittings shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - 1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.
- C. Pipe Cleaning: Should any pipe be plugged or should foaming of water systems occur, disconnect piping, reclean, and reconnect without additional expense to the Owner.
- D. Correct any damage to the building or systems resulting from failure to properly clean the system without additional expense to the Owner.

1.4 SUBMITTALS

- A. Submit the Following:
 - 1. List of piping materials indicating the service it is being used for. (Do not submit piping product data).
 - 2. Product data on mechanical couplings and related components, double wall fuel oil pipe and fittings, and polypropylene waste and vent pipe.
- B. Test Reports and Certificates: Submit certificates of inspections and pipe tests to Owner.
- C. Other: Make certified welders' certificates available.

PART 2 - PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. As indicated.

2.2 CAST IRON SOIL PIPE, SERVICE WEIGHT (NO-HUB)

- A. General: A code approved hubless system conforming to Cast Iron Soil Pipe Institute Standard 301.
- B. Pipe and Fittings: Service weight hubless cast iron conforming to ASTM A 74, marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International. Tyler, AB&I, or Charlotte.
- C. Gaskets: Compression type conforming to ASTM C 564.
- D. Couplings:
 - 1. Above Grade: Band type coupling in conformance with Cast Iron Soil Pipe Institute (CISPI) 310-90, consisting of stainless steel clamp and corrugated shield assemblies with a neoprene sealing sleeve ANSI A21.6, ANSI A21.10 Fittings.
 - 2. Buried: Husky 28 gauge 304 stainless steel hubless type clamp and orange corrugated shield assemblies (80-inch pound torque) with neoprene sealing gaskets (ASTM-C-564), or Clamp-All (125-inch pound torque), 24 gauge 304 stainless steel hubless type clamp, and shield assemblies with neoprene sealing gaskets (ASTM-C-564).
- E. Service:
 - 1. Sanitary, storm, and overflow drain.
 - 2. Vent piping 2 inches and above.

2.3 DUCTILE IRON WATER PIPE

- A. Pipe: Ductile iron pipe conforming to ANSI A21.51.
- B. Fittings: Below grade, Class 150 "Boltite" mechanical joint type complete with gaskets, bolts, and nuts, or "Tyton" for joints employing a single gasket for the joint seal with bell-and-spigot pipe. Above grade, mechanical couplings and fittings as specified herein. Provide interior pipe coating per ANSI Regulation listed.
- C. Service:
 - 1. Below grade, incoming domestic water main, 4 inches and over.
 - 2. Above grade, domestic water piping, 6 inches and over.

2.4 BLACK STEEL PIPE, SCHEDULE 40

- A. General: Fittings and joints must be UL listed for use with pipe chosen for use. Listing restrictions and installation procedures per state and local authorities must be followed.
- B. Pipe: Schedule 40 conforming to ASTM A 135 or A 53.
- C. Fittings: 150 lb. screwed malleable iron on 2 inches and below, Schedule 40 welding fittings conforming to ASTM A 234 for 2-1/2 inches and above or mechanical couplings on select piping as herein specified. Fittings below grade shall be welding fittings. All elbows on pumped systems shall be long radius type. Short radius elbows not acceptable for use except as approved on a case by case basis.

- D. Service:
1. Compressed air piping, except medical compressed air.
 2. Natural gas piping and vent lines.
 3. Fuel oil piping, above grade. Piping concealed in walls shall be socket welded.
 4. Fuel oil vent, fill, and gauge.

2.5 COPPER PIPE

- A. Pipe: Hard drawn copper tubing, Class L or K, ASTM B 88, Made in USA.
- B. Fittings: Wrought copper, 150 psi; ANSI B16.22 for soldered joints, ANSI B16.50 for brazed joints; Chase, Revere, Mueller or approved equal. At contractor's option, a system using mechanically extracted collars in main with branch line inserted to not obstruct flow may be used on domestic water piping above ground, similar to T-drill.
- C. Service:
1. Domestic hot and cold water piping below ground (Type K, hard drawn) on piping 3 inches and smaller.
 2. Domestic hot and cold water piping above ground (Type L, hard drawn) on piping 4 inches and smaller.
 3. Trap priming lines (Type L, annealed).
 4. Pumped waste (DWV).
 5. Miscellaneous drains and overflows.

2.6 FLANGED JOINTS

- A. Flanged Joints: Flanges shall be cast iron or steel for screwed piping and forged steel welding neck for welded line sizes. Pressure rating and drilling shall match the apparatus, valve, or fitting to which they are attached. Flanges shall be in accordance with ANSI B16.1; 150 lb. for system pressures to 150 psig; 300 lb. for system pressures 150 psig to 400 psig. Gaskets for all flanged services, except steam and pumped condensate, shall be Garlock 3700 or equal, 1/8-inch thick, non-metallic type. Gaskets for steam and pumped condensate shall be Flexitauclic Style CG or equal, 1/8-inch thick, semi-metallic type. Make joint using American Standard hexagon head bolts, lock washers, and nuts (per ASTM A307 GR.B) for service pressures to 150 psig; alloy steel stud bolts, lock washer, and American Standard hexagon head nuts (per ASTM A307 GR.B) for service pressures 150 psig to 400 psig. Use length of bolt required for full nut engagement. Provide electro-cad plated bolts and nuts on cold and chilled water lines.

2.7 UNIONS

- A. 150 psi malleable iron, brass to iron seat, ground joint, black or galvanized to match pipe. 200 psi WOG bronze, ground joint, solder type for copper tubing.
1. Unions or flanges for servicing or disconnect are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as disconnect points.)
- B. Dielectric fittings shall be nationally listed, have a dielectric thermoplastic interior lining, and meet requirements of ASTM F-492. Fittings shall be suitable for the pressure and temperature to be encountered.

2.8 MECHANICAL PIPE COUPLINGS AND FITTINGS

- A. Acceptable Manufacturers:
1. Victaulic.
 2. Anvil Gruvlok 7401, 7001.

- 3. Other Manufacturers: Submit Substitution Request.
- B. Coupling: Ductile iron conforming to ASTM A 536, Grade 65-45-12, rust inhibiting paint.
- C. Fittings: Ductile iron conforming to ASTM A 536, Grade 65-45-12. Elbows shall be long radius type.
- D. Bolts and Nuts: Zinc electroplated track head bolts conforming to ASTM A 183.
- E. Gasket: Grade "E" EPDM.
 - 1. Temperature Range: -30°F to 230°F.
- F. Service: Compressed air mains.

2.9 SOLDER AND BRAZING

- A. Brazed Joints:
 - 1. Wrought Copper Piping Fittings: Westinghouse Phos-Copper or Dyna-Flow by J.W. Harris Co., Inc.
 - 2. Applied locations:
 - a. All below grade piping.
 - b. All above grade piping larger than 2-inches for the following services: Industrial cold water, domestic hot and cold water, and pumped waste.
 - c. Oxygen, nitrous oxide, carbon dioxide, medical vacuum, lab vacuum and lab air. Braze in accordance with Copper Development Association Copper Tube Handbook using BCUP series filler material.
 - d. Joints in Domestic Hot and Cold Water Piping: Use mechanically extracted collars. Braze in accordance with Copper Development Association Copper Tube Handbook using BCUP series filler material.
 - e. Solar hot water.
- B. Soldered Joints:
 - 1. Wrought Copper Pipe Fittings: All-State 430 with Duzall Flux, Engelhard Silvacbrite with Engelhard General Purpose Flux or J.W. Harris Co.
 - 2. Valves, Cast Fittings or Bronze Fittings: Harris Stay-Silv-15 or Handy & Harmon Sil-Fos.
 - 3. Applied locations: Above grade piping 2-inch and smaller for the following services: Industrial cold water, domestic hot and cold water, pumped waste, trap priming lines.

2.10 UTILITY MARKERS

- A. Provide plastic tape utility markers over all buried piping. Provide identification on tape.
- B. Material to be Brady Identoline plastic tape, 6-inch, Seton, or as approved.

2.11 PIPE WRAPPING

- A. For all below ground steel piping and fittings, provide complete covering of Scotchrap No. 51, 20 mil thickness, protective tape applied over Scotchrap pipe primer applied at 1 gal/800 SF of pipe surface.
- B. At Contractor's option as approved, pipe may be furnished with factory applied jacket of "X-tru-coat" with Scotchrap as previously specified for field joints.

2.12 FLEXIBLE CONNECTOR

- A. Expansion Joint/Seismic Connector:
 - 1. T304 stainless steel hose and braid, Schedule 40 radius elbows and 180° bend, flange or weld end Schedule 40 fittings. ASA certified when used for natural gas service. Metraflex Metaloop only.
 - 2. Connector shall accept differential support displacement without damaging pipe, equipment connections, or support connections.
 - 3. In steel piping systems, three Victaulic flexible couplings may be used in lieu of a flexible connector for vibration attenuation and stress relief at equipment connections. The couplings shall be placed in close proximity to the vibration source.
- B. Service:
 - 1. Miscellaneous drains and overflows.
 - 2. Domestic hot and cold water piping.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measurements, Lines and Levels:
 - 1. Check dimension at the building site and establish lines and levels for work specified in this Section.
 - 2. Establish all inverts, slopes, and manhole elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with Drawings and Specifications.
 - 3. Use established grid and area lines for locating trenches in relation to building and boundaries.

3.2 EXCAVATION AND BACKFILL

- A. General: Perform all necessary excavation and backfill required for the installation of mechanical work in accord with Division 2. Repair pipelines or other work damaged during excavation and backfilling.
- B. Excavation: Excavate trenches to the necessary depth and width, removing rocks, roots, and stumps. Include additional excavation to facilitate utility crossovers, additional offsets, etc. Excavation material is unclassified. Width of trench shall be adequate for proper installation of piping. The trench shall be widened, if not wide enough for a proper installation.
- C. Bedding: All cast iron, steel, and copper piping shall be full bedded on sand. Place a minimum 4-inch deep layer on the leveled trench bottom for this purpose. Remove the sand to the necessary depth for piping bells and couplings to maintain contact of the pipe on the sand for its entire length. Lay all other piping on a smooth level trench bottom so that contact is made for its entire length.
- D. Backfill: Place in layers not exceeding 8 inches deep, and compact to 95% of standard proctor maximum density at optimum moisture content. Earth backfill shall be free of rocks over 2 inches in diameter and foreign matter. Disposal of excess material as directed.
 - 1. Interior: All backfill under interior slabs shall be bank sand or pea gravel.
 - 2. Exterior: Excavated material may be used outside of buildings at the Contractor's option. The first 4 inches shall be sand, and final 12-inch layer course shall be soil in any event.

3.3 PIPING INSTALLATION

- A. Install unions in all non-flanged piping connections to apparatus and adjacent to all screwed control valves, traps, and appurtenances requiring removal for servicing so located that piping may be disconnected without disturbing the general system.
- B. Mechanical Pipe Couplings and Fittings:
 - 1. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - 2. Flexible couplings to be used only when expansion, contraction, deflection or noise and vibration is to be dampened, as detailed or specified.
 - 3. On systems using galvanized pipe and fittings, fittings shall be galvanized at factory.
 - 4. Before assembly of couplings, lightly coat pipe ends and outside of gaskets with approved lubricant.
 - 5. Pipe grooving in accordance with manufacturer's specifications contained in latest published literature.
 - 6. Gaskets shall be molded and produced by the coupling manufacturer, and shall be suitable for the intended service.
 - 7. The coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the project site to ensure best practices in grooved installation are being followed. (A distributor's representative is not considered qualified to conduct the training or field visits.)
- C. Install all piping as to vent and drain. Install according to manufacturer's recommendations.
- D. Support all piping independently at apparatus so that its weight shall not be carried by the equipment.
- E. Run piping clear of tube cleaning or removal/replacement access area on heat exchangers, water heaters, etc.
- F. Utility Marking: Installed over the entire length of the underground piping utilities. Install plastic tape along both sides and the center line of the trenches at the elevation of approximately 12 inches above the top of utility.
- G. Underground Water System: Prior to testing pipe provide concrete thrust blocks at changes in direction. Block size as required for types of fittings involved.
- H. Dielectric Fittings: Provide dielectric couplings, unions, or flanges between dissimilar metals. In addition, provide dielectric couplings as required to isolate cathodically protected piping and equipment.
- I. No-Hub Couplings: Install per manufacturer's instructions.
- J. Copper Grooved Piping System: Install in strict accordance with latest manufacturer's published literature.

3.4 PIPING JOINTS

- A. Pipe and fittings shall be joined using methods and materials recommended by manufacturer in conformance with standard practice and applicable codes. Cleaning, cutting, reaming, grooving, etc. shall be done with proper tools and equipment. Hacksaw pipe cutting prohibited. Peening of welds to stop leaks not permitted.

- B. Copper Piping: Pipe cut evenly with cutter, ream to full inside diameter; end of pipe and inside of fitting thoroughly cleaned and polished. Joint shall be uniformly heated, and capillary space completely filled with solder or braze material, leaving full bead around entire circumference.

- C. No couplings installed in floor or wall sleeves.

- D. Steel Piping:

1. Screwed Joints: Pipes cut evenly with pipe cutter reamed to full inside diameter with all burrs and cuttings removed. Joints made up with Teflon liquid dope or Teflon tape applied to male threads only, leaving two threads bare. Joints tightened so that not more than two threads are left showing. Junctions between galvanized steel waste pipe and bell of cast iron pipe shall be made with tapped spigot or half coupling on steel pipe to form spigot end and caulked.
2. Flanged Joints: Pressure rating of flanges shall match valve or fitting joined. Joint gaskets shall be coated with graphite and oil.

- E. Welded Joints:

1. Preparation for Welding: Bevel piping on both ends before welding:
 - a. Use following weld spacing on all butt welds:

Nominal Pipe Wall Thickness	Spacing	Bevel
1/4-inch or less	1/8-inch	37-1/2
Over 1/4-inch, less than 3/4-inch	3/16-inch	27-1/2

- b. Before welding, remove all corrosion products and foreign material from surfaces.
 2. Welded Joints: Joints shall be made by the "arc-welding" process using certified welders. Port openings of fittings must match the inside diameter of the pipe to which they are welded. Use full radius welding elbows for all turns, use welding tees for all tees. Reducing fittings must be used for size reduction. "Weldolets" may be used for branches up through one-half the pipe size of the main to which they are attached. Nipples are not allowed.
 3. Welding Operation:
 - a. After deposition, clean each layer of weld metal to remove slag and scale by wire brushing or grinding. Chip where necessary to prepare for proper deposition of next layer.
 - b. Weld reinforcement no less than 1/16-inch not more than 1/8-inch above normal surface of jointed sections. Reinforcement crowned at center and taper on each side to surfaces being joined. Exposed surface of weld shall present professional appearance and be free of depressions below surface of jointed members.
 - c. No welding shall be done when temperature of base metal is lower than 0°F. Material to be welded during freezing temperatures shall be made warm and dry before welding is started. Metal shall be "warm to the hand" or approximately 60°F.

- F. Flexible Connector: Provide where indicated on the Drawings.

- G. Ductile Iron Pipe: Install per manufacturer's instructions.

- H. Piping above Sensitive Areas: Remove existing 2-band no-hub connectors above sensitive areas and replace with 4-band connectors.

3.5 INSTALLATION, PIPE WRAP

- A. Apply per manufacturer's written instructions.

- B. Apply wrapping to fittings in field after installation.

3.6 ADJUSTING AND CLEANING

- A. General:
 - 1. Clean interior of all piping before installation.
 - 2. Flush sediment out of all piping systems after installation before connecting plumbing fixtures to the piping.
 - 3. When placing the water systems in service during construction, each system shall be cleaned by circulating a solution with 1000 ppm (1#20 gallon) of trisodium phosphate for 24 hours, then drained, flushed and placed in service.
 - 4. Clean all strainers prior to placing in service.

END OF SECTION

**SECTION 22 30 00
PLUMBING EQUIPMENT****PART 1 GENERAL****1.1 SUMMARY**

- A. This Section includes:
 - 1. Water Heaters
 - 2. Domestic Water Expansion Tanks
 - 3. Backflow Preventers

1.2 RELATED SECTIONS

- A. Division 01, General Requirements
- B. Division 22, Plumbing
- C. Section 22 40 00, Plumbing Fixtures
- D. Section 23 31 01, HVAC Ducts and Casing – Low Pressure
- E. Section 23 51 00, Breechings, Chimneys and Stacks

1.3 QUALITY ASSURANCE

- A. General:
 - 1. Contractor is responsible for obtaining and payment for permits, licenses, and inspection certificates required in accordance with provisions of Contract Documents.
- B. Regulatory Requirements:
 - 1. Water heaters to meet state energy code requirements.
 - 2. Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction.

1.4 SUBMITTALS

- A. Provide submittals in accordance with Section 22 05 00, Common Work Results for Plumbing.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including, but not limited to, the following:
 - 1. Preparation instructions and recommendations.
 - 2. Detailed shipping, storage, and handling requirements and recommendations.
 - 3. Installation, operating, and maintenance manuals.
- C. Shop Drawings: Submit the following for review and approval prior to fabrication:
 - 1. Detailed shop drawings complete with all accessories supplied by the manufacturer.
 - 2. Drawings and calculations including but not limited to the following:
 - a. Seismic bracing details and calculations.
 - b. Underground Equipment: Underground details including foundations, compaction, and backfill details and calculations; buoyancy calculations.
- D. Calculations:
 - 1. Oil/Water Separators: Provide buoyancy calculations for below grade installations in high water table conditions to prevent tank float out.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with manufacturer's Installation and Operating Guidelines recommendations for delivery, storage, and handling.

1.6 WARRANTY

- A. Provide a written guaranty covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.
- B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a minimum period of one year from the date of Owner acceptance of Work of this Division.
- C. Provide manufacturer's written warranties for materials and equipment furnished under this Division insuring parts and labor for extended periods as described for each product.
- D. Correct warranty items promptly upon notification.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Water Heaters:
 - 1. Electric Water Heater:
 - a. A.O. Smith
 - b. Bradford-White
 - c. Rheem
 - d. Other Manufacturers: Submit substitution request.
- B. Domestic Water Expansion Tank:
 - 1. Amtrol
 - 2. Bell & Gossett
 - 3. Armstrong
 - 4. Wheatley
 - 5. Taco
 - 6. Other Manufacturers: Submit substitution request.
- C. Backflow Preventers:
 - 1. Watts
 - 2. Febco
 - 3. Wilkins
 - 4. Hersey
 - 5. Apollo
 - 6. Ames
 - 7. Other Manufacturers: Submit substitution request.
- D. Utility Vaults:
 - 1. Utility Vault Co.
 - 2. RCP Concrete Product

2.2 WATER HEATERS

- A. Electric Water Heater:
 - 1. Construct heater of heavy gauge steel, fluorocarbon polymer, epoxy, or glass lined, 150 psi working pressure (ASME rated for 125 gallon size and above).
 - 2. Equip heater with sacrificial magnesium anode unless fluorocarbon polymer lined.
 - 3. Heating elements of the inconel sheath rod type.
 - 4. One external adjusting thermostat for each element.
 - 5. Immersion thermostats to switch magnetic contactors through a staged sequence control (60 KW and larger).

6. Insulate tank with foam insulation to comply with ASHRAE 90 standards and local codes, with a baked enamel steel jacket.
7. Manual reset high limit thermostat, ASME rated temperature and pressure relief valve and drain valve.
8. Heater UL listed, prewired, and factory tested.
9. See Drawings for size and capacity.

2.3 DOMESTIC WATER EXPANSION TANK

- A. Diaphragm type of welded steel, constructed and stamped in accordance with ASME code for 150 psi working pressure.
- B. Heavy-duty butyl diaphragm meets FDA requirements for potable water supply.
- C. Support with steel legs or bases for vertical installation or steel saddles for horizontal installation.
- D. Pre-charged with compressed air to minimum fill pressures as indicated on the Drawings.

2.4 BACKFLOW PREVENTERS

- A. Reduced Pressure Backflow Assembly (RPBA) Type:
 1. 2-inch Size and Smaller:
 - a. Screwed ends with bubble-tight ball valves, bronze main valve body and cover, bronze main valve with stainless steel 316 trim and four test cocks.
 - b. Maximum working pressure of 150 psi unless scheduled.
 2. 2-1/2-inch Size and Larger:
 - a. Flanged ends with non-rising stem shutoff valves, cast iron main valve body and cover with epoxy coated interior, bronze main valve trim, bronze differential relief valve with stainless steel 316 trim and four test cocks.
 - b. Maximum working pressure of 150 psi unless scheduled.
- B. Double Check Valve Assembly (DCVA) Type:
 1. 2-inch Size:
 - a. Flanged ends, bronze, check valve body and cover and bronze check valve trim.
 - b. Complete unit consisting of two independently acting spring-loaded toggle lever check valves, and two shutoff valves and four test cocks.
 2. 2-1/2-inch through 10-inch Size:
 - a. Flanged ends, cast iron check valve body and cover and bronze check valve trim.
 - b. Complete unit consisting of two independently acting spring-loaded toggle lever check valves, and two shutoff valves and four test cocks.
- C. Double Check Detector Assembly (DCDA) Type: 3-inch through 10-inch size with 3/4-inch bypass line, OS&Y type of shutoff valve with tattle-tale meter, main line check valve body and cover cast iron epoxy coated internally, bypass line check valve body and cover bronze and check valve trim bronze, and four test cocks.
- D. Vacuum Breakers:
 1. Atmospheric Type (AVB):
 - a. 1/2-inch through 2-inch size, all brass body, non-spilling type, 150 psig working pressure with maximum temperature of 140 degrees F.
 - b. Rough brass finish.

PART 3 EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install per manufacturer's installation instructions and in accordance with all applicable codes.
- B. Provide pressure/temperature relief valve on storage tanks. Provide piping from relief valve to floor drain utilizing a 1-inch air gap at discharge point.
- C. Support:
 - 1. Install water heater oriented so that controls and devices needing service and maintenance have adequate access.
 - 2. Install water heaters level.
 - 3. Provide required strapping to structure and floor in accordance with code requirements.
- D. Water Piping:
 - 1. Provide hot and cold water piping to units with shutoff valves, unions, and specialties as detailed on the Drawings.
 - 2. Provide recirculating water line to unit with shutoff valve, check valve, and union.

3.2 BACKFLOW PREVENTERS

- A. Install at height and location suitable for testing purposes by the local governing authority.
- B. Provide funnel drain below reduced pressure backflow device for collecting periodic discharge and testing purposes.
- C. Pipe 2-inch indirect waste from funnel drain to floor drain. Discharge indirect waste above floor drain utilizing a 1-inch air gap.

END OF SECTION

**SECTION 22 40 00
PLUMBING FIXTURES****PART 1 GENERAL****1.1 SUMMARY**

- A. This Section includes:
 - 1. Fixture Trim
 - 2. Plumbing Fixtures
 - 3. Drainage Products

1.2 RELATED SECTIONS

- A. Division 01, General Requirements
- B. Division 22, Plumbing

1.3 QUALITY ASSURANCE

- A. Water Closets: Maximum Performance (MaP) score of no less than 800
- B. Faucets: Certify to NSF/ANSI 61 and California AB1953
- C. Electric Water Coolers and Drinking Fountains: Certified to NSF/ANSI 61 and California AB1953
- D. Emergency Eyewash and Emergency Shower Equipment: Comply with ANSI Standard Z358.1

1.4 SUBMITTALS

- A. Submit the following:
 - 1. Product data for each item specified.
 - 2. Operating and Maintenance Data:
 - a. Electric Water Coolers
 - b. Whirlpool Baths
 - c. Hot Water Dispensers
 - d. Garbage Disposals
 - e. Sensor Operated Faucets
 - f. Sensor Operated Flush Valves.
 - 3. Mounting heights for fixtures.

PART 2 PRODUCTS**2.1 MANUFACTURERS**

- A. Manufacturers are stated for each fixture specified. The following manufacturers are also acceptable, except when indicated only.
- B. Fixture Trim:
 - 1. Supply Stops:
 - a. Chicago
 - b. NPT McGuire (LK series)
 - c. Brasscraft (SCR series)
 - 2. Traps:
 - a. McGuire
 - b. Kenney

- c. Brasscraft
- 3. Support Rims:
 - a. Hudee
- 4. Vacuum Breakers:
 - a. Chicago Faucet
 - b. A.W. Cash
 - c. Febco, chrome plated
- C. Drainage Products and Carrier Products:
 - 1. J.R. Smith
 - 2. Josam
 - 3. Sioux Chief
 - 4. Zurn
 - 5. Wade
 - 6. Watts Drainage
 - 7. Woodford
 - 8. Mifab
- D. Fixtures:
 - 1. American Standard
 - 2. Kohler
 - 3. Sloan
 - 4. Toto
- E. Seats:
 - 1. Olsonite
 - 2. Church
 - 3. Beneke
 - 4. Bemis
- F. Electric Water Coolers:
 - 1. Elkay
 - 2. Halsey Taylor
 - 3. Oasis
 - 4. Sunroc
 - 5. Haws
- G. Mixing Valves:
 - 1. Powers
 - 2. Leonard
 - 3. Symmons
 - 4. Chicago
- H. Emergency Fixtures:
 - 1. Haws
 - 2. Bradley
 - 3. Speakman
 - 4. Encon

- I. Emergency Fixture Mixing Valves:
 - 1. Leonard
 - 2. Bradley
 - 3. Lawler
 - 4. Powers
- J. Stainless Steel Products:
 - 1. Elkay
 - 2. Just
 - 3. Franke
- K. Shower/Tub Controls:
 - 1. Delta Commercial
 - 2. Kohler
 - 3. Symmons
 - 4. Powers
 - 5. Moen Commercial
- L. Shower/Tub Enclosure:
 - 1. Aquatic Bath
 - 2. Everfab
 - 3. Maax
- M. Mop Sinks:
 - 1. Fiat
 - 2. Williams
 - 3. Mustee
- N. Faucets:
 - 1. Chicago
 - 2. Delta Commercial
 - 3. Kohler
 - 4. Symmons
 - 5. Moen Commercial
- O. Disposals and Hot Water Dispenser:
 - 1. In-Sink-Erator
- P. Flush Valves:
 - 1. Sloan
 - 2. Zurn
 - 3. Kohler
 - 4. Toto
- Q. Sensor Operated Faucets:
 - 1. Sloan
 - 2. Chicago
 - 3. Delta Commercial
 - 4. Moen Commercial
- R. Shock Arrestors:

1. PPP
 2. Mifab
 3. J.R. Smith
- S. Trap Primer:
1. PPP
- T. Exposed Waste and Supply Piping Insulation Kits:
1. Truebro
 2. McGuire
- U. Other Manufacturers: Submit substitution request.

2.2 FIXTURE TRIM

- A. Supply Stops: Chicago cast brass rigid riser supplies with loose key angle stops, wall flanges, NPT female inlet, chrome plate finish; equivalent NPT McGuire (LK series), Brasscraft (SCR series), or NPT stops by fixture supplier.
- B. Traps:
1. For floor drains, provide coated cast iron P-trap; recessed, screw jointed or bell and spigot.
 2. For other fixtures, provide 17 gauge, chrome plated cast brass P-Traps with solder bushings, and clean-out.
- C. Support Rims: Hudee stainless steel rims, if sink not furnished with integral rim.
- D. Vacuum Breakers:
1. Chicago Faucet
 2. A.W. Cash
 3. Febco, chrome plated

2.3 PLUMBING FIXTURES AND DRAINAGE PRODUCTS

- A. Refer to Schedules for complete fixture and drainage product information.

PART 3 EXECUTION

3.1 FIXTURE TRIM

- A. Provide plumbing fixture trim where applicable on fixtures, including but not limited to supply stops, traps, support rims, flush valve, and vacuum breakers.
- B. Provide rough-in and final piping connection to fixtures. Carefully review all construction documents to assure that all fixtures are provided with necessary services for a complete operating system.
- C. Rigidly secure rough-in piping, carriers and supports, and other service piping to structure.

3.2 PLUMBING FIXTURES

- A. Americans with Disabilities Act:
1. Those fixtures indicated by ADA complies with and be installed in accordance with Americans with Disabilities Act Guidelines (ADAAG). Where applicable building code requirements are more stringent than ADAAG guidelines, building code requirements followed.
 2. Water Closets:
 - a. Mounting height of ADA water closet 17-inches to 19-inches from floor to top of the toilet seat.
 - b. Mount flush valve for ADA water closets on wide side of enclosure.
 3. Lavatories:

- a. Mounting height of ADA lavatories at a maximum height of 34 inches from floor to rim.
 - b. Provide insulation kits on exposed hot water and waste piping beneath ADA lavatories.
4. Sinks: Provide insulation kits on exposed hot water and waste piping beneath ADA sinks.
5. Urinals: Mounting height of ADA water closet at a maximum height of 17-inches from floor to top rim.
- B. Fixture Mounting Heights: Fixtures standard rough-in catalogued heights unless shown otherwise on the Architectural Drawings.
- C. Showers:
 1. Piping from shower mixing valve to shower head rigid pipe. PEX piping not allowed.
 2. Shower Head Mounting Heights: Mount so that face of head is at 6-feet-6-inches above finished floor and not to conflict with shower enclosure.
- D. Water Supplies: When both hot and cold water to a fixture is required, connect the hot on the left and the cold on the right.
- E. Floor Mounted Supports and Chair Carriers:
 1. Secure floor mounted supports and chair carriers to slab with a minimum of 1/2-inch bolts.
 2. Install supports and carriers per manufacturer's installation instructions.
- F. Lavatories, Urinals and Water Closets with Hard-Wired Electronic Sensors:
 1. Install sensors, wiring and piping as recommended by manufacturer.
 2. Provide vandalproof screws on wiring boxes for lavatories and sensor boxes.
 3. Mount lavatory wiring box on bottom of countertop for total concealment. Coordinate with Division 26 for plug-in transformer and receptacle locations.
 4. Provide one 24V transformer for any combination of 10 water closets or urinals installed side by side, and one transformer for every 6 lavatories installed side by side.
- G. Lavatories:
 1. Public Toilet Room: Grid strainers.
 2. Private Toilet Room: Pop-up waste assemblies.
 3. Those lavatories indicated as ADA are ADA compatible. Coordinate with Architect to verify if all wall hung lavatories are to be installed at ADA height.
- H. Floor Drain and Floor Sinks:
 1. Set top flush with finished floor.
 2. Provide flashing clamp for all drain bodies installed in floors provided with waterproof membranes.
- I. Cleanout:
 1. Where shown or required.
 2. Cover set flush with finished surface.
- J. Roof and Area Drains:
 1. Provide sump receivers for all drains except poured in place installations.
 2. Provide extension section as required to compensate for the specified insulation thickness above the roof slab or deck.
- K. Water Hammer Arresters: Provide where shown and where recommended by Plumbing Drainage Institute (PDI).

- L. Water Coolers and Drinking Fountains:
 - 1. Water-bearing materials comply with the Safe Drinking Water Act of 1986 and the Lead Contamination Control Act of 1988. The waterway system of the unit manufactured of copper components and other completely lead-free materials.
 - 2. Water cooler refrigerants will be non-CFC.
 - 3. Provide fixture manufacturer's wall mounting plate or floor mounted support for all wall-hung water coolers or drinking fountains.
- M. Mixing Valves: Provide piping connections per manufacturer's installation instructions.
- N. Water closets equipped with a dual flush devices marked with the reduced flush volume and the designation ASME A112.19.14 to signify compliance with the standard.
- O. Wall hung lavatories with pop-up waste assemblies: Verify there is no vertical pull rod assembly conflict with lavatory backsplash prior to submitting product data.

3.3 PRIMING VALVES

- A. All floor drains, floor sinks, and similar traps primed. Use minimum 3/8-inch type K annealed copper tubing. Primer line to be continuous and without joints.
- B. Where priming valves are installed in finished rooms, conceal in wall and provide access panel.
- C. Coordinate locations of electronic trap primer stations with electrical contractor for 120V service.

END OF SECTION

SECTION 23 05 94

CLEANING OF HVAC EXISTING DUCTWORK

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.
- B. The provisions of Section 23 05 00 Common Work Results for HVAC apply to work specified in this Section.

1.2 SUMMARY

- A. This section defines the minimum requirements necessary to render existing HVAC components clean and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards. Removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.
- B. The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The return air grilles, return air ducts to the air handling unit (AHU), the interior surfaces of the AHU, mixing box, coil compartment, condensate drain pans, supply air ducts, fans, fan housing, fan blades, turning vanes, filters, filter housings, reheat coils and supply diffusers are all considered part of the HVAC system. The HVAC system may also include other components such as dedicated exhaust and ventilation components and make-up air systems.

1.3 QUALITY ASSURANCE

- A. Membership: The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA) or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.
- B. Certification: The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
- C. Supervisor Qualification: A person certified as an ACSC by NADCA or maintaining an equivalent certification by a nationally recognized program and organization shall be responsible for the total work herein specified.
- D. Experience: The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the owner. Bids shall only considered from firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.
- E. Equipment, Materials and Labor: The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials and labor to adequately perform the specified services.
 - 1. The contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration and as described by this specification. For work performed in countries outside of the U.S.A. contractors should comply with applicable national safety codes and standards.
 - 2. The contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification.
 - 3. Contractor shall submit to the owner all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.
- F. Licensing: The HVAC system cleaning contractor shall provide proof of maintaining the proper license(s), if any as required to do work in this state. Contractor shall comply with all Federal, state and local rules, regulations and licensing requirements.

1.4 STANDARDS

- A. NADCA Standards: The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).
 - 1. All terms in this specification shall have their meaning defined as stated in the NADCA Standards.
 - 2. NADCA Standards must be followed with no modification or deviations being allowed.

1.5 APPLICABLE STANDARDS AND PUBLICATIONS

- A. The following current standards and publications of the issues currently in effect form a part of this specification to the extent indicated by any reference thereto:
 - 1. National Air Duct Cleaners Association (NADCA): "Assessment, Cleaning and Restoration of HVAC Systems (ACR 2005)" 2004.
 - 2. National Air Duct Cleaners Association (NADCA): "Understanding Microbial Contamination in HVAC Systems" 1996.
 - 3. National Air Duct Cleaners Association (NADCA): "Introduction to HVAC System Cleaning Services" 2004.

4. National Air Duct Cleaners Association (NADCA): Standard 05 "Requirements for the Installation of Service Openings in HVAC Systems" 2004.
5. Underwriters/ Laboratories (UL): UL Standard 181.
6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAW): Standard 62-89 "Ventilation for Acceptable Indoor Air Quality."
7. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62-89 "Ventilation for Acceptable Indoor Air Quality."
8. Environmental Protection Agency (EPA): "Building Air Quality" December 1991.
9. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): "HVAC Duct Construction Standards – Metal and Flexible" 1985.
10. North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems" 1993.

1.6 SUBMITTALS

- A. Submit qualification of the HVAC System Cleaning Contractor

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION

3.1 HVAC SYSTEM COMPONENT INSPECTIONS AND SITE PREPARATIONS

- A. HVAC System Component Inspection: Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools and equipment required to satisfactorily complete this project. The cleanliness inspection should include air handling units and representative areas of the HVAC system components and ductwork. In HVAC systems that include multiple air handling units, a representative sample of the units should be inspected.
- B. The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification or other debris. In cases where contamination is suspected and/or in sensitive environments where even small amounts of contaminant may be of concern, environment engineering control measures should be implemented.
 1. Damage system components found during the inspection shall be documented and brought to the attention of the owner.
- C. Site evaluation and Preparation: Contractor shall conduct a site evaluation and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.
- D. Inspector Qualifications: Qualified personnel should perform the HVAC cleanliness inspection to determine the need for cleaning. At minimum, such personnel should have an understanding of HVAC system design and experience in utilizing accepted indoor environmental sampling practices, current industry HVAC cleaning procedures and applicable industry standards.

3.2 GENERAL HVAC SYSTEM CLEANING REQUIREMENTS

- A. Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.
- B. Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, mechanical cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.
- C. Controlling Odors: Measures shall be employed to control odors and/or mist vapors during the cleaning process.
- D. Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be visibly clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.
- E. Air-Volume Control Devices: Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning, and upon completion, must be restored to their marked position.
- F. Service Openings: The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and inspection.
 - 1. Contractor shall utilize the existing service openings already installed in the HVAC system where possible.
 - 2. Other openings shall be created where needed and they must be created so they can be sealed in accordance with industry codes and standards.
 - 3. Closures must not significantly hinder, restrict or alter the airflow within the system.
 - 4. Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.
 - 5. Openings must not compromise the structural integrity of the system.
 - 6. Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, applicable NFPA, SMACNA and NADCA Standards.
 - 7. Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.
 - 8. Rigid fiber glass duct systems shall be resealed in accordance with NAIMA recommended practices. Only closure techniques that comply with UL Standard 181 or UL Standard 181a are suitable for fiber glass duct system closures.
 - 9. All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the owner in project report documents.

- G. Ceiling Sections (Tile): The contractor may remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.
- H. Air Distribution Devices (Registers, Grilles and Diffusers): The contractor shall clean all air distribution devices.
- I. Air Handling Units, Terminal Units (VAV, Dual Duct Boxes, etc.), Blowers and Exhaust Fans: The contractor shall insure that supply, return and exhaust fans and blowers are thoroughly cleaned. Areas to be cleaned include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers and drive assemblies. All visible surface contamination deposits shall be removed in accordance with NADCA Standards. Contractor shall:
 - 1. Clean all air handling units (AHU) internal surfaces, components and condensate collectors and drains.
 - 2. Assure that a suitable operative drainage system is in place prior to beginning wash down procedures.
 - 3. Clean all coils and related components, including evaporator fins.
- J. Duct Systems: Contractor shall:
 - 1. Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.
 - 2. Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Tests (see NADCA Standards).

3.3 HEALTH AND SAFETY

- A. Safety Standards: Cleaning contractors shall comply with applicable federal, state and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.
- B. Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.
- C. Disposal of Debris: All debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

3.4 MECHANICAL CLEANING METHODOLOGY

- A. Source Removal Cleaning Methods: The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select Source Removal methods that will render the HVAC system visibly clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified test, in accordance with all general requirements. No cleaning method or combination of methods shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.
 - 1. All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.
 - 2. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters.

3. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility.
 4. All methods require mechanical agitation devices to dislodge debris adhere to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those, which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.
- B. Methods of Cleaning Fibrous Glass Insulated Components:
1. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.
 2. Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards).
- C. Damage Fibrous Glass Material:
1. Evidence of damage: If there is any evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.
 2. Replacement material: In the event fiber glass materials must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMCNA.
- D. Cleaning of Coils:
1. Any cleaning method may be used which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification (see applicable NADCA Standards). Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drain pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement of, inhibit heat transfer or erosion of the coil surface or fin and shall conform to coil manufacturer recommendations when available. Coils shall be thoroughly rinsed with clean water to remove any latent residues.
- E. Antimicrobial Agents and Coatings:
1. Antimicrobial agents shall only be applied if active fungal growth is reasonably suspected or where unacceptable levels of fungal contamination have been verified through testing.
 2. Application of any antimicrobial agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.
 3. When used, antimicrobial treatments and coatings shall be applied in strict accordance with the manufacturers' written recommendations and EPA registration listing.
 4. Antimicrobial coatings shall be applied according to the manufacturer's written instructions; Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces.

3.5 CLEANLINESS VERIFICATION

- A. General: verification of HVAC system cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment related substance to the HVAC system, including biocidal agents and coatings.
- B. Visual inspection: The HVAC system shall be inspected visually to ensure that no visible contaminants are present.
 - 1. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean, however, the owner reserves the right further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA Standards.
 - 2. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
 - 3. NADCA vacuum test analysis should be performed by a qualified third party experienced in testing of this nature.
- C. Verification of Coil Cleaning:
 - 1. Cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see NADCA Standards).

3.6 PRE-EXISTING SYSTEM DAMAGE

- A. Provide notice of any pre-existing systems damage to owner prior to any work.

3.7 POST-PROJECT REPORT

- A. At the conclusion of the project, the Contractor shall provide a report to the owner indicating the following:
 - 1. Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
 - 2. Areas of the system found to be damaged and/or in need of repair.

END OF SECTION

SECTION 23 05 00**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 1 Specification Sections, apply to this Section.
- B. The provisions of This Section, Common Work Results for HVAC, apply to all sections in Division 23.
- C. All Sections of Division 23 are interrelated. When interpreting any direction, material, and method specified in any section of Division 23, consider it within the entirety of Work in Division 23.

1.2 SUMMARY

- A. The intent of Division 23 Specifications and the accompanying Drawings is to provide a complete and workable facility with complete systems as shown, specified and required by applicable codes. Include all work specified in Division 23 and shown on the accompanying Drawings, including appurtenances, connections, etc., in the finished job.
- B. The Division 23 Specifications and the accompanying Drawings are complimentary and what is called for by one shall be as binding as if called for by both. Items shown on the Drawings are not necessarily included in the Specifications and vice versa. Specifications shall supersede drawings in case of conflict.
- C. Imperative language is frequently used in Division 23 Specifications. Except as otherwise specified, requirements expressed imperatively are to be performed by the Contractor.
- D. The Drawings that accompany the Division 23 Specifications are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Offsets and transitions shall be assumed at a minimum at each duct crossing, structural penetrations through shear walls or beams, structural grids where ceiling heights are restricted, and at piping mains. Follow the Drawing as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the Building, subject to approval, and without additional cost to the Owner. The right is reserved to make any reasonable changes in outlet location prior to roughing-in, without cost impact.

1.3 RELATED WORK

- A. The General and Supplemental Conditions apply to this Division, including but not limited to:
 - 1. Drawings and specifications.
 - 2. Public ordinances, permits.
 - 3. Include payments and fees required by governing authorities for work of this Division.
- B. Division 1, General Requirements, applies to this Division.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. General: All work and materials shall conform to the local and State codes, and all Federal, State and other applicable laws and regulations.
 - 2. Contractor responsible for obtaining and payment for all permits, licenses, and inspection certificates required in accordance with provisions of Contract Documents.
- B. Materials and equipment shall be new. Work shall be of good quality, free of faults and defects and in conformance with the Contract Documents.
- C. Apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was designed.
- D. The entire mechanical system and apparatus shall operate at full capacity without objectionable noise or vibration.
- E. All equipment shall be installed level and true. Housekeeping pads and curbs shall account for floor or roof slope.
- F. Materials and Equipment:
 - 1. Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications and shall be suitable for the installation shown. Equipment not meeting all requirements will not be acceptable, even though specified by name along with other manufacturers.
 - 2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of same manufacturer.
 - 3. Furnish all materials and equipment of size, make, type, and quality herein specified.
 - 4. Equipment scheduled by performance or model number shall be considered the basis of the design. If other specified manufacturer's equipment is provided in lieu of the basis of design equipment the contractor is responsible for all changes and costs which may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements or any other differences which impact the project.
- G. Workmanship:
 - 1. General: All materials shall be installed in a neat and professional manner.
 - 2. Manufacturer's Instructions: Follow manufacturer's directions where they cover points not specifically indicated. If they are in conflict with the Drawings and Division 23 Specifications, obtain clarification before starting work.
- H. Cutting and Patching:
 - 1. Cutting, patching, and repairing for the proper installation and completion of the work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting shall be performed by skilled craftsmen of each respective trade in conformance with the appropriate Division of Work.
 - 2. Additional openings required in building construction shall be made by drilling or cutting. Use of jackhammer is specifically prohibited.
 - 3. Fill holes which are cut oversize so that a tight fit is obtained around the sleeves passing through.
 - 4. Beams or columns shall not be pierced without permission of Architect and then only as directed.
 - 5. All new or existing work cut or damaged shall be restored to its original condition. Where alterations disturb lawns, paving, walks, etc., the surfaces shall be repaired, refinished, and left in condition existing prior to commencement of work.

1.5 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit shop drawings for review prior to beginning fabrication. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field or when there is a question as to whether contract documents are being complied with or the design intent is being met.
- B. Product Data:
 - 1. In general, submit product data for review on all scheduled pieces of equipment, on all equipment requiring electrical connections or connections by other trades, and as required by each specification section or by Drawing notes. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets shall include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures, and similar data. Manufacturer's abbreviations or codes are not acceptable.
 - 2. List the name of the motor manufacturer and service factor for each piece of equipment.
 - 3. Indicate equipment operating weights including bases and weight distribution at support points.
 - 4. In the case of equipment such as wiring devices, time switches, valves, etc., specified by specific catalog number, a statement of conformance will suffice.
- C. Submission Requirements:
 - 1. Shop Drawings and Product Data:
 - a. Refer to Division 1 for additional requirements related to submittals.
- D. Contractor Responsibilities: It shall be the Contractor's responsibility to:
 - 1. See that all submittals are submitted at one time and are in proper order.
 - 2. Ensure that all equipment will fit in the space provided.
 - 3. Assure that all deviations from Drawings and Specifications are specifically noted in the submittals. Failure to comply will void review automatically.

1.6 OPERATING AND MAINTENANCE MANUAL, PARTS LISTS, AND OWNERS INSTRUCTIONS

- A. Refer to Division 1 for additional requirements.
- B. Instruct Owner thoroughly in proper operation of equipment and systems, in accordance with manufacturer's instruction manuals. Operating instructions shall cover all phases of control.

1.7 PROJECT CONDITIONS

- A. Existing Conditions: Prior to bidding, verify and become familiar with all existing conditions by visiting the site, and include all factors which may affect the execution of this Work. Include all related costs in the initial bid proposal.
- B. Coordinate exact requirements governed by actual job conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.
- C. Coordinate shutdown and start-up of existing, temporary, and new systems and utilities. Notify Owner, City and Utility Company.

1.8 WARRANTY

- A. Provide a written guaranty covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.

- B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of Owner acceptance of Work of this Division.
- C. Correct warranty items promptly upon notification.

1.9 PROVISIONS FOR LARGE EQUIPMENT

- A. Contractor shall make provisions for the necessary openings in building to allow for admittance of all equipment.

1.10 TEST REPORTS AND CERTIFICATES

- A. Contractor shall submit one copy of all test reports and certificates specified herein to the Architect.

1.11 SUBSTITUTIONS

- A. Contractor shall submit any requests for product substitutions in accordance with the Instructions to Bidders and the General and Supplemental Conditions.

PART 2 - PRODUCTS

2.1 ACCESS PANELS

- A. Furnish under this Division as specified in another Division of work.

2.2 ELECTRICAL EQUIPMENT

- A. General: All equipment and installed work shall be as specified under Division 26, Electrical.
- B. Coordinate with the electrical Drawings and electrical contractor for minimum electrical equipment bracing requirements based on the available interrupting current (AIC) rating at the bus of the panelboard or switchboard serving the piece of equipment. Provide equipment that meets the bracing requirement.
- C. Equipment Wiring: Interconnecting wiring within or on a piece of mechanical equipment shall be provided with the equipment unless shown otherwise. This does not include the wiring of motors, starters and controllers provided under Division 26, Electrical.
- D. Codes: All electrical equipment and products shall bear the Underwriters label as required by governing codes and ordinances.

PART 3 - EXECUTION

3.1 ACCESS PANELS

- A. Install in accord with manufacturer's recommendations, coordinated with architectural features.
- B. Provide 2-hour fire rated doors where required bearing the U.L. label.
- C. Furnish 18x18-inch panels for ceilings and for access to equipment in soffits and shafts, and 12"x12" for walls unless indicated otherwise.

- D. Furnish where indicated and where required to access valves, fire/smoke dampers, balance dampers, and other appurtenances requiring operation, service or maintenance. Submit proposed locations for review prior to installation.

3.2 SLEEVES

- A. Interior Floor and Wall Sleeves: Provide sleeves large enough to provide 3/4-inch clearances around pipe or ductwork. Where pipe or ductwork is insulated, insulation shall pass continuously through sleeve with 3/4-inch clearance between insulation and sleeve. Penetrations through mechanical room and fan room floors shall be made watertight by packing with safing insulation and sealing with Tremco Dymeric Sealant or approved system.
- B. Sleeves Through Rated Floors and Walls: Similar to interior sleeves except install fire rated system approved by Authority Having Jurisdiction and Owners insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping or duct material, size and service.
- C. Sleeves specified or indicated at fire damper penetrations shall take precedence over this article.

3.3 CLEANING

- A. General: Clean mechanical equipment, piping and ductwork of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.
- C. Additional requirements are specified under specific Sections of this Division.

3.4 EQUIPMENT PROTECTION

- A. Keep pipe, ductwork and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, ductwork, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment, or apparatus to original conditions or replace at no cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.5 ACCESSIBILITY

- A. General: Locate equipment or specialties requiring frequent reading, adjustments, inspection, repairs, and removal or replacement conveniently and accessibly with reference to the finished building.

3.6 FLOOR, WALL AND CEILING PLATES

- A. Install on piping and ductwork passing through finished walls, floors, ceilings, partitions, and plaster furrings. Plates shall completely cover opening around pipe and duct.
- B. Secure wall and ceiling plates to pipe, insulation, or structure.

- C. Plates shall not penetrate insulation vapor barriers.
- D. Plates not required in mechanical rooms or unfinished spaces.

3.7 PAINTING

- A. General: Coordinate painting of mechanical equipment and items with products and methods in conformance with the appropriate Division of Work, Painting. All exposed work under this division shall receive either a factory painted finish or a field prime coat finish, except:
 - 1. Exposed copper piping.
 - 2. Aluminum jacketed outdoor insulated piping.
- B. Concealed Spaces (above ceilings, not visible):
 - 1. Insulation: Not painted.
 - 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Valve Bodies and Bonnets: Not painted.

3.8 ADJUSTING AND CLEANING

- A. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.
- B. Use particular care in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment as approved or replace with new equipment.

3.9 ELECTRICAL EQUIPMENT

- A. Ductwork or piping for mechanical systems not serving electrical space shall not be installed in any switchgear room, transformer vault, telephone room, or electric closet except as indicated.
- B. Ductwork or piping for mechanical systems shall not pass over switchboards or electrical panelboards. Where conflicts exist, bring to attention of Architect.

3.10 EQUIPMENT CONNECTIONS

- A. Make final connections to equipment specified in sections other than Division 23 of the specifications and Owner furnished equipment in accordance with manufacturer's instructions and shop drawings furnished and as indicated.
- B. Ductwork: Make exhaust connections to fume hoods, emergency generator radiators, and any other processing, laboratory, or kitchen equipment in strict accordance with manufacturer's instructions.

END OF SECTION

SECTION 23 05 53**IDENTIFICATION 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 1 Specification Sections, apply to this Section.
- B. The provisions of Section 23 05 00, Common Work Results for HVAC apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes: Identify equipment components of the mechanical systems to indicate their function and system served.

1.3 SUBMITTALS

- A. Submit the following:
 - 1. Equipment Nameplate Directory: Submit for approval prior to fabrication.

PART 2 - PRODUCTS**2.1 EQUIPMENT IDENTIFICATION**

- A. Nameplates:
 - 1. Tag all fans and miscellaneous items of mechanical equipment with engraved nameplates. Nameplates shall be 1/16-inch thick, 3 x 5 laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
 - 2. Identify unit with equipment tag as shown on Drawings and area served.
 - 3. Access points to fire dampers, smoke dampers, and combination fire and smoke dampers shall be permanently identified on the exterior of the duct by a label with letters 1/2-inch in height reading: Fire Damper, Smoke Damper, or Fire/Smoke Damper, as appropriate. Label constructed from same material as equipment nameplates.

PART 3 - EXECUTION**3.1 EQUIPMENT IDENTIFICATION**

- A. Nameplates: Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.
- B. Nameplate Directory: Post final copy in Operation and Maintenance Manual.

END OF SECTION

SECTION 23 05 93**TESTING, ADJUSTING AND BALANCING****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.
- B. The provisions of Section 23 05 00, Common Work Results for HVAC apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes:
 - 1. Testing and balancing of air systems.
 - 2. Testing and balancing of miscellaneous mechanical equipment.

1.3 QUALITY ASSURANCE

- A. Testing and Balancing Firm Qualifications:
 - 1. The Contractor shall procure the services of an independent balance and testing agency, approved by the Architect, which specializes in the balancing and testing of plumbing, heating, ventilating, and air conditioning systems, to balance and adjust air moving equipment and air distribution or exhaust systems as herein specified.
 - 2. The testing agency shall provide proof of having successfully completed at least five projects of similar size and scope. Testing and balancing work shall be done under direct supervision of registered professional engineer who has been employed by the Agency a minimum of one year prior to start of project.
- B. Industrial Standards: Testing and Balancing shall conform to NEBB, American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), and American National Standards Institute (ANSI) as follows:
 - 1. NEBB: Comply with Procedural Standards for Testing, Adjusting Balancing of Environmental Systems.
 - 2. ASHRAE: Comply with recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing.
 - 3. ANSI:
 - a. S1.4 Specifications for sound level meters.
 - b. S1.11 Specifications for Octave-Band and Fractional-Octave-Band analog and digital filters.
- C. Instrument Certification: All instruments used shall be accurately calibrated and certified within six months of balancing and maintained in good working order.
- D. Test Observation: If requested, the tests shall be conducted in the presence of the Architect or the Architect's representative.

1.4 SUBMITTALS

- A. Submit the following:

1. Balancing Log: Include all air and water outlets, actual field measured air and water volume, and percentage of design volumes. Provide drawings identifying location of all outlets.
2. Equipment Data Sheets: Indicate actual equipment performance, model numbers, bearing and belt data, motor nameplate data, and final balanced motor data.
3. Additional Data: Submit all additional data as provided by Associated Air Balance Council (AABC) Standard forms.
4. Instrument Certification: When requested, submit certificate of calibration for all equipment to be used.

- B. Record data on NEBB forms or forms approved by the Architect.

1.5 PROJECT CONDITIONS

- A. Where existing systems are to be adjusted, establish flow rates in all branches prior to making any modifications to system. Submit preliminary report indicating existing conditions prior to making any modifications to existing systems. Adjust central equipment as required and restore all unmodified branches and outlets to original condition. Obtain existing system drawings from Owner and become familiar with extent and nature of existing systems.
- B. Do not perform final testing, adjusting, and balancing work until heating, ventilating, and air conditioning equipment has been completely installed and operating continuously as required.
- C. Conduct air testing and balancing with clean filters in place.

1.6 WARRANTIES

- A. In addition to the Requirements of the Contract, include an extended warranty of six months after completion of test and balance work during which time the Architect at his discretion may request a recheck or resetting of any equipment or device listed in the test reports.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION

3.1 AIR SYSTEMS

- A. General: Make measurements in accord with Industrial Standards specified above. Record on appropriate forms.
- B. Preliminary:
1. Identify and list size, type, and manufacture of all equipment to be tested including air outlets and inlets.
 2. Use manufacturer's ratings for equipment to make required calculations except where field test shows ratings to be impractical.
- C. Central System:
1. Adjust fan speeds and motor drives for required air volume within $\pm 5\%$ maximum. Set speed to provide air volume at farthest run without excess static pressure. Provide additional sheaves and belts as required to accomplish speed adjustment.
 2. Read and adjust air supply, return, and exhaust fan units to deliver design conditions at minimum O.S.A. and at 100% O.S.A.

3. Adjust all automatic dampers, outside air, return air, and exhaust dampers for design conditions.
 4. Read static air pressure conditions on all air handling equipment including filter and coil pressure drops and total pressure across the fan. A Dwyer Series 400 air velocity meter only shall be used for final static pressures at equipment and where critical readings are required.
 5. Measure temperature conditions across all outside air, return air, and exhaust dampers to check leakage.
 6. Read and record motor data and amperage draw.
 7. For variable volume systems, establish minimum static pressure required at sensing point to permit operation over entire VAV range. Adjust supply and return fan speed so that at maximum demand the associated VFD is controlling the motor of motor nameplate RPM to 100%. Adjust return fan speed so that return air volumes track with supply air volume minus exhaust air volume.
 8. Assist controls contractor in establishing minimum outside air damper positions.
- D. Distribution:
1. Read and adjust all air outlets to design air volumes within $\pm 10\%$ maximum. Advise Engineer if deficiencies are generally noted to enable proper corrective actions.
 2. Evaluate all building and room pressure conditions to determine adequate supply and return air conditions. Generally, the building shall be balanced to be slightly positive to outdoors.
 3. Evaluate all building and room pressure conditions to determine adequate performance of the system to maintain temperatures without draft.
 4. Perform multipoint pitot traverses to confirm instrumentation, shaft tightness, fan operation, etc. Pitot traverses shall be performed using a Dwyer Series 400 air velocity meter only with applicable duct probe.
 5. Mark all balancing dampers.

3.2 AUTOMATIC CONTROL SYSTEM

- A. In cooperation with control manufacturer's representative, set and adjust automatically operated devices to achieve required sequence of operations.
- B. Testing organization shall verify all controls for proper calibration and list controls requiring adjustment by control system installer.

3.3 COORDINATION

- A. Coordinate work with other trades to ensure rapid completion of the project.
- B. Deficiencies noted during the course of air balancing in the mechanical installation shall be promptly reported to the Architect to allow corrective action to proceed.
- C. Periodic review of progress shall be provided as requested.

END OF SECTION

SECTION 23 07 00**INSULATION 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.
- B. The provisions of Section 23 05 00, Common Work Results for HVAC apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes: Insulation for ductwork and equipment.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Flame and Smoke Ratings: Installed composite flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by UL 723.
 - 2. Energy Codes: Local Building and Energy Codes shall govern where insulation performance requirements for thickness exceeds thickness specified.
- B. Protection: Protect against dirt, water, chemical, or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost.
- C. Source Quality Control:
 - 1. Service: Use insulation specifically manufactured for service specified.
 - 2. Labeling: Insulation labeled or stamped with brand name and number.
 - 3. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, shall not react corrosively with equipment, piping, or ductwork, and shall be asbestos free.

1.4 SUBMITTALS

- A. Submit the following.
 - 1. Product Data: For each type including density, conductivity, thickness, jacket, vapor barrier, and flame spread and smoke developed indices.

PART 2 - PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. Equivalent products by Johns Manville, Knauf, Owens Corning, and CertainTeed are acceptable.
- B. All such insulation shall be of one manufacturer.
- C. Other Manufacturers: Submit Substitution Request.

2.2 DUCTWORK BLANKET INSULATION

- A. Fiberglass: 1.0 pcf nominal density, 0.25 per inch maximum K-factor at 75°F mean temperature, 250°F minimum operating temperature limit. Johns Manville Microlite Type 100 with facing as follows:
 - 1. Exposed: FSK facing (foil scrim Kraft) or vinyl - white appearance.
 - 2. Concealed with Vapor Barrier: FSK reinforced foil and paper.
 - 3. Concealed without Vapor Barrier: Facing not required.
- B. Semi-Rigid Fiberglass: 2.5 pcf nominal density, 0.24 per inch maximum K-factor, at 75°F mean temperature, 250°F minimum operating temperature limit. Johns Manville Micro-Flex with facing as follows:
 - 1. Exposed: FSK facing (foil scrim kraft) or vinyl-white appearance.
 - 2. Concealed with Vapor Barrier: FSK reinforced foil and paper.
 - 3. Concealed without Vapor Barrier: Facing not required.

2.3 DUCTWORK BOARD INSULATION

- A. Semi-Rigid Fiberglass: 0.23 per inch maximum K-factor at 75°F mean temperature, 250°F minimum operating temperature limit and all purpose vapor barrier facing with white Kraft paper finish. Micro-Aire Duct Board Type LP.
- B. Rigid Fiberglass: Same as semi-rigid except with 4.0 pcf density and 0.23 per inch maximum K-factor. Johns Manville Diffuser Board.

2.4 DUCT ACOUSTICAL WRAP

- A. Barrier shall be constructed of a 0.10-inch thick mass loaded, limp vinyl sheet bonded to a layer of reinforced aluminum foil on one side. The barrier shall have a nominal density of 1 lb per square foot and minimum STC rating of 28. The barrier shall have a minimum thermal conductivity value of 0.29 and a rated service temperature range of -40 degrees F. to 220 degree F. Barrier shall have a flame spread index of no more than 10 and a smoke development index of less than 40.
- B. The decoupling layer shall be a combination of 1-inch fiberglass batting, non woven porous scrim-coated glass cloth, quilted together in a matrix of 4-inch diamond stitch pattern which encapsulates the glass fibers. The composite material shall be fabricated to include a nominal 6-inch wide barrier overlap tab extending beyond the quilted fiber glass to facilitate a leak-tight seal around field joints.
- C. Kinectics Noise Control model KNM-100ALQ.

2.5 ACCESSORIES DUCTWORK

- A. Adhesives:
 - 1. Fiberglass: Zeston Z-Glu.
- B. Cements:
 - 1. Insulating: Ryder.
 - 2. Heat Transfer: Zeston Z-20.
- C. Wire Mesh: 1-inch mesh with 20 gauge annealed steel wire.
- D. Mastic: Chicago Mastic:
 - 1. Vapor Barrier: 17-475.

- 2. Outdoor Mastic: 16-110 white.
- E. Cloth Facing: Presized fiberglass cloth.
- F. Tapes: Pressure sensitive, weather resistant, and for temperatures up to 150°F. Zeston Z-tape.
- G. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the PVC fitting covers, elastomeric, aluminum facing, Kraft paper, tapes and adhesives.

PART 3 - EXECUTION

3.1 GENERAL

- A. Workmanship:
 - 1. Installation: Insulation installed in first class, neat professional manner.
 - 2. Applicators: Applicators shall be employed by firm that specializes in insulation work.
- B. Preparation: Surfaces of piping, ductwork and equipment clean, free of oil or dirt, and dry before insulation is applied.
- C. Stamps: ASME stamps, UL labels, and similar stamps and labels shall not be covered.

3.2 EQUIPMENT INSTALLATION

- A. General: Install true and smooth. Insulation over curved surfaces shall conform to curves of surface.
 - 1. Access: Insulated removable heads, water boxes, pump casings, access, etc., that require service, inspection or maintenance shall be provided with covers or section that are easily removable and replaceable. Reinforce openings in adjacent insulation with metal beading. In vapor barriered insulation, coat joints with vapor barrier mastic.
 - 2. Voids, Depressions and Cavities: All voids, chipped corners and other openings shall be filled with insulating cement or material compatible with insulating material.
 - 3. Vapor Barriered Insulation: Where insulation is specified to have a vapor barrier, the barrier shall not be pierced or broken.
 - a. Tears, etc., shall be coated with vapor barrier mastic and patched with insulation facing or tape.
 - b. Staples brush coated with vapor barrier coating.
 - c. All raw edges coated with vapor barrier mastic shall be covered and cover shall be sealed to equipment surface.
 - 4. Non-Vapor Barriered Insulation:
 - a. Tears, etc., shall be patched with insulation facing or tape.
 - b. All raw edges shall be covered and neatly beveled to the equipment surface.
 - 5. Multilayered Insulation: With staggered joints.
- B. Calcium Silicate and Fiberglass Block:
 - 1. Anchors: Lug nuts 10 gauge black annealed iron wire welded to metal surfaces.
 - 2. Banding: Block secured to surface with 1/2-inch wide stainless steel bands maximum 18-inches on center and secured to anchors.
 - 3. Insulating Cement: Block covered with insulating cement minimum thickness of 1/2-inch with smooth finish.
 - 4. Vapor Barriered System: On vapor barriered system, apply continuous coat of vapor barrier mastic.

5. Finish: Finish with cloth facing secured with adhesive and lapped a minimum of 2 inches. Defects touched up with finishing cement.
- C. Elastomeric Blanket: Cut insulation to size, make corners with mitering cuts to preclude raw edges, continuously cement insulation to equipment with adhesive. Cement both surfaces of joints and butt tightly together and cover raw edges with two coats of adhesive.
- D. Expansion Joints: Covered with larger size pipe insulation to allow full movement and be removable, ends turned back to pipe, coat with vapor barrier mastic on joints in vapor barriered system and finished with cloth facing cemented to insulation with adhesive.
- E. Boiler Breeching, Steel Stacks and Gas Flues: As specified under calcium silicate block except air space 1 inch from metal with air space vented to room and atmosphere.
- F. Heat Exchangers: Insulation thickness and material as specified for piping and applicable service.

3.3 DUCT INSULATION APPLIED LOCATIONS

- A. General:
 1. All external insulation with continuous vapor barriers unless specifically noted otherwise.
 2. Internally lined shall be lined completely to grille or diffuser or to indicated terminal points. Dimension shown are net inside of liner.
 3. Internally lined ductwork need not be externally insulated.
 4. In addition to locations described in specification, internally line medium, low, return and exhaust air ductwork where shown on drawings.
- B. Insulation Applied Location – HVAC Ductwork: Refer to schedule on drawings

3.4 DUCTWORK INSTALLATION

- A. General:
 1. Install in accordance with manufacturer's instruction.
 2. The vapor barrier shall be continuous. Tears, holes, staples, etc. shall be coated with vapor barrier mastic and patch with facing or tape. Joints between insulation and access with vapor barrier mastic.
 3. Insulation at access panels to be removable or attached to panel with edges of panel and opening reinforced with metal beading.
- B. External Blanket Insulation:
 1. Insulation secured to ductwork with 20-gauge snap wires 24 inches on center and at all joints.
 2. Joints and seams lapped a minimum of 3 inches and sealed with jacket tape.
- C. Board Insulation:
 1. Rectangular ducts with weld pins spaced a maximum of 18 inches on center in both directions.
 2. All corners made with joints, bending insulation around corners not allowed.
 3. All joints and seams butted tight together.
 4. Butt joints with 3-inch wide tape.
 5. Corners finished with 3-inch wide tape.

- D. Internal Duct Liner:
1. The coated surface shall face air stream.
 2. Weld pins spaced maximum of 15-inch on center in both directions and within 2 inches of all corners and joints. Weld pins flush with liner surface.
 3. Complete duct surface coated with adhesive and insulation pressed tightly thereto.
 4. Edges at terminal points shall be provided with metal beading and heavily coated with adhesive.
 5. All joints and corners shall be heavily coated with adhesive.
 6. Damaged areas replaced or heavily coated with adhesive.
- E. Duct Enclosure - Fire Rated:
1. Installation: Per manufacturer's instructions.
 2. Joints:
 - a. Attached boards shall be cemented and attached to one another. Mating surfaces shall be "buttered" with a 1/8-inch layer adhesive.
 - b. Secure fiberglass type material with stainless steel banding (type 304).
 3. Support: The duct enclosure may be hung from a conventional "trapeze" arrangement. Adequate support shall be provided at the bottom of vertical runs. On multi-story vertical runs, the Firetemp enclosure shall be supported at each story penetration with an angle iron collar attached to the Firetemp.
 4. Expansion: Adequate clearance shall be provided at the end of all straight runs to allow for expansion of the metal duct inside the enclosure.
- F. Plenums: Insulation on floors protected by wire mesh.
- G. Blank Off Panels: Insulation, enclosed with sheet metal on all sides. All joints with vapor barrier mastic and taped.
- H. Volume Dampers: Where volume dampers do not allow for continuous insulation, terminate insulation clear of handle sweep and finish edges to maintain vapor barrier and to prevent damage to the insulation.

3.5 DUCT ACOUSTICAL WRAP

- A. Installed in accordance with the manufacturer's instructions.
- B. Applied locations for piping and duct systems:
1. All variable and constant volume terminal units with maximum air volumes over 2000 cfm. Wrap installed such that control devices are easily accessible without circumventing the acoustical value.
 2. Where specified or indicated on drawings.

3.6 FIELD QUALITY CONTROL

- A. Field Test: All systems shall be tested and approved prior to installation of insulation.
- B. Existing Insulation:
1. Repair existing insulation damaged during construction.
 2. Make neat connections where new and existing insulation meet.
 3. Where existing piping, ductwork or equipment is removed, cover existing surfaces neatly to match existing.
 4. Where existing insulation is damaged or missing, notify the architect prior to performing to work.

END OF SECTION

SECTION 23 09 00

INSTRUMENTATION AND CONTROLS 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.
- B. The provisions of Section 23 05 00, Common Work Results for HVAC apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes: Provide complete automatic control system.
- B. Related Sections include:
 - 1. Section 23 05 93 Testing, Adjusting and Balancing.
 - 2. Section 23 09 93 Sequence of Operation for HVAC Controls.
- C. Furnish a native BACnet Energy Management System (EMS) as specified herein. The operator's workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2016, BACnet. In other words, all workstations and controllers, including unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections.
- D. The native BACnet EMS shall be as specified herein and consist of a high-speed, peer-to-peer local area network of DDC controllers connected to a dedicated Server PC and other client workstation PC's and Lap Top computers as specified. All HVAC and/or Electrical system points monitored and controlled by the EMS, including the building floor plans as well as all control devices, will be depicted by point-and-click graphics.
- E. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers. All controller devices must be BTL tested and listed by the official BACnet Testing Laboratory, having the BTL approval mark issued with Rev 15 or later listing for the MS/TP devices.
- F. All devices in this new project facility location shall be accessible from a single graphical user interface.
- G. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.
- H. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.
- I. Furnish and install the required software to produce a complete and operational native BACnet EMS as specified herein.

- J. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.
- K. Provide a comprehensive operator and technician training program as described herein.
- L. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.
- M. Work Required Under Other Divisions Related to This Section:
 - 1. Power wiring to line side of motor starters, disconnects or variable frequency drives.
 - 2. Provision and wiring of smoke detectors and devices relating to fire alarm system.
 - 3. Campus LAN (Ethernet) connection adjacent to Operator Workstation.

1.3 SYSTEM DESCRIPTION

- A. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-2016, BACnet and achieved listing under the BACnet Testing Laboratories BACnet - Advanced Workstation Software (B-AWS). This system is to control all mechanical equipment, including all unitary equipment such as heat pumps, fan-coils, AC units, etc., and all air handlers, boilers, cooling towers, and any other listed equipment using native BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.
- B. Operator's workstation software shall be 64-bit operating system running Windows 10 as the computer operating system. The Energy Management System (EMS) application program shall be written to communicate specifically utilizing BACnet protocols. Software functions delivered on this project shall include password protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, after-hours billing program, demand limiting, and a full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited. All software required to program EMS application specific controllers and all field level devices and controllers will be left with the owner. All software passwords required to program and make future changes to the system will also become the property of the owner. All software required to make any program changes anywhere in the system, along with scheduling and trending applications, will be left with the owner. All software passwords required to program and make future changes to schedules, trends and related program changes will also become the property of the owner. All software required for all field engineering tools including graphical programming and applications will be left with the owner. All software passwords required to program and make future changes to field engineering tools, including graphical programming and applications will be left with the owner.
- C. Building controllers shall include complete energy management software, including scheduling building control strategies with optimum start and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator's terminal. Operator's terminal software is to be used for access to field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage.
- D. All application controllers for every terminal unit (HP, UV, etc.), air handler, all central plant equipment, and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller through BACnet LAN.

E. System Architecture

1. Connection between all Integration Level Global Controllers, the BACnet Server and any client work stations (PC's or Lap Tops) shall be high-speed, peer-to-peer Ethernet as per Standard IEEE802.3. Owner shall furnish and maintain IT WAN infrastructure.
2. EMS Contractor shall provide and install a dedicated MS/TP LAN extending from all Global Controller's to distributed field level controller BACnet devices.
3. Distributed field level controllers are responsible for directly controlling and monitoring HVAC and Electrical system points throughout the facility.
4. The BACnet Server hosts system configurations, programming databases and stores all trend log data. The Server maintains all backup files for system configuration and programming located on Global Controller's and field level controllers and is capable of directly uploading or downloading information from the controllers.
5. An operator's workstation and/or any designated portable operator's terminal (if specified) shall be used as a graphical user interface to provide system supervision, management report generation and alarm annunciation.

1.4 QUALITY ASSURANCE

- A. The Contractor shall be regularly engaged in the manufacturing, installation and maintenance of EMS systems and shall have demonstrated technical expertise and experience in the manufacture, installation and maintenance of EMS systems similar in size and complexity to this project.
- B. The EMS system shall be designed, installed, commissioned, and serviced by manufacturer-authorized and trained personnel. System provider shall have an in-place support facility within 50 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.
- C. To provide the level of support and response required by the Owner, the Energy Management System Contractor shall have a fully staffed service. 24/7 Service Call Center staffed by live operators enabling immediate response to Owner's critical emergency EMS concerns.
- D. EMS Contractor shall have a proven record of successful native BACnet installations and maintenance of equivalent native BACnet systems for a minimum period of 5 years utilizing the same native BACnet manufacturer's product line that the Contractor proposes to use on this project.
- E. Materials and equipment shall be manufacturer's latest standard design that complies with the specification requirements.
- F. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.
- G. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

1.5 SUBMITTALS

- A. Drawings
 1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.
 2. Drawings shall be submitted as PDF.
- B. System Documentation

Include the following in submittal package:

1. System configuration diagrams in simplified block format.
 2. All input/output object listings and an alarm point summary listing.
 3. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
 4. Complete bill of materials, valve schedule and damper schedule.
 5. Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
 6. Overall system operation and maintenance instructions—including preventive maintenance and troubleshooting instructions.
 7. For all system elements—operator's workstation(s), building controller(s), application controllers, routers, and repeaters—provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ASHRAE Standard 135-2016.
 8. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.
 9. A list of all functions available and a sample of function block programming that shall be part of delivered system.
- C. Testing Submittals: Provide test plan and test procedures for approval. Explain in detail, step-by-step, actions and expected results to demonstrate compliance with the requirements of this specification and methods for simulating necessary conditions of operation to demonstrate performance of the system. Test plan and test procedures shall demonstrate capability of system to monitor and control equipment and to accomplish control and monitoring specified.
- D. Operation and Maintenance Manuals: Provide manual within 30 days after completing acceptance tests. Manuals shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and of nearest service representatives for each item of equipment and each system. Place tab sheets at beginning of each chapter or section and at beginning of each appendix. Final copy delivered after completion of the acceptance tests shall include all modifications made during installation, checkout, and acceptance. Operation and Maintenance Manuals to include hardware manual, software manual, operations manual, and maintenance manual.
1. Hardware Manual: Furnish a hardware manual describing all equipment provided, including:
 - a. General description and specifications.
 - b. Installation and checkout procedures.
 - c. Equipment electrical schematics and layout drawings.
 - d. System schematics and I-O wiring lists.
 - e. Alignment and calibration procedures.
 2. Software Manual: The software manual shall describe all furnished software. The manual shall be oriented to programmers and shall describe calling requirements, data exchange requirements, data file requirements, and other information necessary to enable proper integration, loading, testing, and program execution. Provide one software manual per Operator's Terminal.
 3. Operator's Manual: The operator's manual shall provide all procedures and instructions for operation of the system, including:
 - a. DDC panels and peripherals.
 - b. System start-up and shutdown procedures.
 - c. Use of system, command, and applications software.
 - d. Alarm presentation.
 - e. Recovery and restart procedures.
 - f. Report generation.
 - g. System schematic graphics.
 - h. Provide one Operator's Manual per Operator's Terminal.

4. Maintenance Manual: The maintenance manual shall provide descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
5. Acceptance Test Forms: Maintenance manual shall include copies of signed-off acceptance test forms.

1.6 ACCEPTANCE TESTING AND TRAINING

- A. Site Testing:
 1. General: Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform testing. Owner or Owner's representative will witness and sign off on acceptance testing.
 2. Acceptance Test: Contractor shall demonstrate compliance of completed control system with contract documents. Using approved test plan, all physical and functional requirements of project shall be demonstrated.
- B. Training:
 1. General: Contractor shall conduct training courses for designated personnel in operation and maintenance of system. Training shall be oriented to specific system being installed under this contract. Training manuals shall be provided for each trainee, with two additional copies provided for archival at project site. Manuals shall include detailed description of the subject matter for each lesson. Copies of audiovisuals shall be delivered to Owner. Notification of any planned training shall be given to the Owner's representative at least 15 days prior to the training.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/INSTALLERS

- A. Acceptable Manufacturers/Installers:
 1. The base bid shall be from Alerton Technologies by Syserco.

2.2 MATERIALS AND EQUIPMENT

- A. Controls and Power Wiring:
 1. General: Electric equipment and wiring shall be in accordance with Division 26. Manual or automatic control and protective or signal devices required for operation specified, and any control wiring required for controls and devices, shall be provided hereunder.
 2. Wiring:
 - a. Field and Subfield Panels: Voltage in panels shall not exceed 120 volts. Where devices are wired to higher voltages, mount in suitable individual enclosures or group in separate control panel. Coordinate electrical power supply with Division 26.
 - b. Motor Control Centers: Responsibility for correct voltage of holding coils and starter wiring in pre-wired motor control centers interfacing with automatic controls is included hereunder.
 - c. Wiring for DDC systems communications buses shall be two conductor minimum 18 gauge foil-shielded, stranded twisted pair cable rated at 300 VDC or more than 80°C.
 3. Communications Links Surge Protection: Protect all communications equipment against surges induced on any communications link. All cables and conductors which serve as communications links shall have surge protection circuits installed that meet the requirements of REA PE-60d.

4. Communications Links Overvoltage Protection: Protect all communications equipment against overvoltage on any communications link conductors. All cables and conductors which serve as communications links shall have overvoltage protection for voltages up to 480 VAC rms, 60 Hz installed. Instrument fuses or fusible resistors are acceptable for this application.
5. Power Line Surge Protection: Protect all equipment connected to AC circuits from power line surges. Fuses shall not be used for surge protection.

B. Control Panels:

1. Wall mounted control panels shall be provided as required to contain all relays, terminal strips, power supplies and other equipment in building control system.
2. Panels shall be U.L. listed, minimum NEMA 1, minimum 14 gauge steel with stiffeners, continuous hinge doors, locking handles, single point latch.

2.3 ADVANCED APPLICATION CONTROLLERS

- A. Provide one or more native BACnet advanced application controllers for HVAC equipment requiring DDC standalone control independent of building control module operation. All controllers shall interface to building controller through either MS/TP LAN using BACnet protocol, or Ethernet LAN using BACnet over Ethernet or BACnet TCP/IP. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation and be the same tool as used for the building controller. No auxiliary or non-BACnet controllers shall be used.
- B. BACnet Conformance
1. Application controllers shall be approved by the BTL as meeting the BACnet Application Specific Controller requirements.
 2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
 3. Standard BACnet object types supported shall include, as a minimum, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Multi-state Values, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- C. Application controllers shall include universal inputs with 12-bit resolution that accept 3K and 10K thermistors, 0–10VDC, Platinum 1000 Ohm RTD, 0–5VDC, 4–20mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of three (3) inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs with 10-bit resolution shall support either 0–10VDC or 0–20mA. Binary outputs shall have LED indication of status. Software shall include scaling features for analog outputs. Application controller shall include 20VDC voltage supply for use as power supply to external sensors.
1. All outputs must have on-board Hand-Off-Auto (HOA) switches and a status indicator light. HOA switch position shall be monitored. Each analog output shall include a potentiometer for manually adjusting the output when the HOA switch is in the Hand position. The position of each and every HOA switch shall be available system wide as a BACnet object property.

- D. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller up to 20 times per second (minimum of 10 times per second) and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal.
1. The following control blocks shall be supported:
 2. Natural Log
 3. Exponential
 4. Log base 10
 5. X to the power of Y
 6. Nth square root of X
 7. 5th Order Polynomial Equations
 8. Astronomical Clock (sunrise/sunset calculation)
 9. Time-based schedules
- E. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely using modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using programming tools as described in operator's terminal section.
- F. Application controller shall include support for intelligent room sensor (see Section 2.9.B.) Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode, based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.
- G. Schedules
1. The controller shall support a minimum of three (3) BACnet Schedule Objects and have a real-time clock on board with battery backup to maintain time through a power loss.
- H. Logging Capabilities
1. Controller shall support a minimum of 50 trend logs. Any object in the controller (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
 2. Controller shall periodically upload trended data to system server for long-term archiving if desired. Archived data stored in (MS Jet Database or SQL) database form and shall be available for use in third-party spreadsheet or database programs.
- I. Alarm Generation
1. Alarms may be generated within the controller for any object change of value or state (either real or calculated). This includes things such as analog object value changes, and binary object state changes.
 2. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.
 3. Controller must be able to handle up to 25 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.
- J. The controller processor shall be a 64-bit processor.
- K. The packaging of the controller shall provide operable doors to cover the terminals once installation is complete. The housing of the controller shall provide for DIN rail mounting and also fully enclose circuit board.

2.4 APPLICATION SPECIFIC CONTROLLERS

- A. Provide one or more native BACnet application controller for HVAC equipment requiring DDC standalone control independent of building control module operation and for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller through MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.
- B. BACnet Conformance
- C. Application controllers shall, as a minimum, support MS/TP BACnet LAN types. They shall communicate directly using this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be approved by the BTL as meeting the BACnet Application Specific Controller requirements and support all BACnet services necessary to provide the following BACnet functional groups:
- D. Files Functional Group
- E. Reinitialize Functional Group
- F. Device Communications Functional Group
- G. Please refer to Section 22.2, BACnet Functional Groups in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- H. Standard BACnet object types supported shall include, as a minimum, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- I. Application controllers shall include universal inputs with 16-bit resolution that can accept 3K and 10K thermistors, 0–5VDC, 4–20mA, dry contact signals and a minimum of three (3) pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.
- J. All program sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely through modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.

- K. Application controller shall include support for intelligent room sensor (see Section 2.9.B.) Display on room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

2.5 BACNET THERMOSTAT

- A. General. Provide a fully programmable BACnet MS/TP thermostat equipped with onboard inputs and outputs. The BACnet Thermostat shall have a standard temperature sensor with humidity, CO2 and motion options. The display shall include a RGB LED backlight for multicolor LCD and button illumination that provides additional user feedback and esthetic appeal. NFC technology shall enables installers to use NFC-enabled mobile devices to configure the thermostat.
1. The BACnet Thermostat shall operate on 24VAC or 24VDC power.
 2. The BACnet Thermostat shall have sufficient memory to support its operating system, database, and programming requirements.
 3. BACnet Thermostats shall be fully peer to peer.
 4. The operating system of the Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.
 5. All equipment that requires scheduling shall be scheduled in that equipment's controller.
 6. Both firmware and controller database shall be loadable over the network.
 7. BACnet Thermostat shall support the following sensors:
 - a. Digital Temperature Sensor +/- 0.2°C (+/- 0.36°F)
 - b. Digital Humidity Sensor Accuracy +/- 3%
 - c. CO2 Sensor Dual Beam, Self Calibrating NDIR Detection Range: 0-2000 ppm
 - d. Occupancy Sensor Passive infrared motion (PIR) sensor Range: 5 m (16.4 ft.) Coverage: 100° Horizontal
 8. Thermostat backlight shall illuminate automatically based on user interaction. Where motion detection option is specified, backlight shall activate automatically based on user approach. In both cases, backlight shall dim based on programmable timeout.
 9. Specified thermostat shall have RGB backlight capable of displaying a range of colors. Backlight shall be (programmable \ user adjustable \ variable based on input).
 10. The thermostat backlight shall signify when the controlled equipment has been commanded into heating, cooling or economy mode with a red, blue and green light respectively.
 11. The thermostat shall signal when an alarm has been sent from the third party notification system. The thermostat will display a flashing color as specified by the alarm code of the occupant.
 12. The provided thermostat shall have backlit buttons or a backlit button interface allowing full use of all features and functions of the device in a dark environment.
 13. Specified thermostat must have NFC communication chip onboard allowing for wireless configuration and addressing of the device via smartphone, tablet or other like device.
 14. The thermostat must have universal external inputs capable of reading a dry contact, remote wired temperature sensors, or 0-5VDC / 0-10VDC signal.
 15. Binary outputs shall be solid-state type, capable of switching 24VAC or 24VDC, both internally or externally sourced up to 0.5Amp current.
 16. Analog outputs shall support 0-10VDC with up to 20mA current.
 17. The thermostat shall support trend logs capable of storing data locally on the controller. This data shall be written to serial type memory as to persist through loss of power.
- B. Communication
1. Each BACnet Thermostat shall support BACnet MS/TP, at 9,600/19,200/38,400/76,800bps baud rates.

2. The controller shall provide a service communication port using BACnet Data Link/ Physical layer protocol for connection to portable operator's workstation and allow access to the entire network.
 3. The thermostat shall have a service port for local network access, capable of being enabled or disabled through software.
- C. Environment. Controller 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 0° to 55°C (32° to 131°F), 10 - 90% RH (non-condensing).
- D. Memory. The BACnet Thermostat shall utilize non-volatile FLASH memory to maintain its operating system and backup all operator entered changes to setpoints, schedules, and commands.

2.6 AUXILIARY CONTROL DEVICES

- A. All thermostats shall be in a lockable cover.
- B. Temperature Sensors
1. All temperature sensors to be solid-state electronic, interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings and in a lockable cover. Mount 48 inches above finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake, and in a location that is in the shade most of the day.
- C. Intelligent Room Sensor with Touch Screen
1. Hardware
 - a. Room sensor shall include:
 - 1) Backlit touch screen LCD digital display
 - 2) Temperature sensor
 - 3) Humidity Sensor
 - 4) Programmable Status Light indicator
 - 5) CO2 Sensor (as scheduled on prints)
 - b. Temperature sensor shall be a Uni-CuVe Type II thermistor with an accuracy of +/- 0.36 °F (0.2 °C) at calibration point over the range of 32-116 °F or better.
 - c. Humidity sensor shall have an accuracy of +/-3% from 10-90% relative humidity or better.
 - d. The intelligent room sensor's Smart Light shall have a minimum of four colors (Blue, Red, Amber and Green) that will cast a glow onto the wall below the sensor to be used as visual indicator to the occupants of the condition of the system. The color and on/off state of smart light shall be fully programmable.
 - e. CO2 Sensor shall have an accuracy of +/- 30 ppm over the range of 0-5000 ppm or better.
 - f. CO2 sensor shall utilize Automatic Baseline Correction to maintain sensor calibration without need for manual calibration.
 - g. The user shall interact with the smart sensor using a touch screen, with no buttons allowed.
 - h. The intelligent room sensor shall have provisions for a tamper proof installation requiring tools to be removed from the wall.
 - i. The touch screen shall have a surface hardness of Mohs 7 or greater to prevent being easily scratched.

- j. Controller shall function as room control unit and allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator.
 - 2. Display Content
 - a. The intelligent room sensor shall simultaneously display room setpoint, room temperature, and outside temperature at each controller.
 - b. The intelligent room sensor shall have the ability to add or remove from the display time-of-day, room humidity, and indoor air temp to customize the view for the customer.
 - c. The intelligent room sensor must have the capability to show temperatures in degrees Fahrenheit or degrees Centigrade.
 - d. A communication loss or improper communications wiring shall be displayed on the LCD screen to aid in trouble shooting.
 - e. Information about the version of firmware shall be displayable on the LCD screen.
 - f. A cleaning mode will be provided to allow for the touch screen to be cleaned without inadvertently making changes to system parameters.
 - g. The intelligent room sensor shall have the ability to display the status of a lighting zone status and control the on/off state of the zone from the touch screen using a tenant accessible display page.
 - h. The intelligent room sensor shall have the ability to display the status of a window zone (e.g. blinds) and control the on/off state of the zone from the touch screen using a tenant accessible display page.
 - i. After Hours Override shall:
 - j. Override time may be set and viewed in 30 minute increments.
 - k. Override time countdown shall be automatic, but may be reset to zero by occupant from the sensor.
 - l. Time remaining shall be displayed.
 - m. Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.
 - 3. Other Modes
 - a. The intelligent room sensor shall also allow service technician access to hidden functions for advanced system configuration. This functionality shall be accessed protected with a configurable pin number.
 - b. Field service mode shall allow access to common parameters as dictated by the application's sequence of operations. The parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.
 - c. Balance mode shall, if intelligent room sensor is connected to VAV controller, allow a VAV box to be balanced and all air flow parameters viewed. The balancing parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.
 - 4. Intelligent Room Sensor shall be in compliance of the following:
 - a. UL Standard for Safety 916
 - b. FCC Part 15.107 & 109, Class B, CFR47-15
 - c. EMC Directive 89/336/EEC (European CE Mark)
 - 5. Manufacturer: Alerton MicroSet 4 or approved equal
- D. Sensors
- 1. Standard wall sensor shall use solid-state sensor identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function, warmer/cooler lever for set point adjustment and port for plug-in of Field Service Tool for field adjustments. Override time shall be stored in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All programmable variables shall be available to field service tool through wall sensor port.

Manufacturer	Alerton or Approved Equal

Model	MicroTouch
Temperature Monitoring Range	32°F to 158°F
Output Signal	Changing resistance (10K Ω)
Accuracy at Calibration Point	$\pm 0.36^\circ\text{F}$ (+/- 0.2°C)
Set Point and Display Range	N/A Blank

2. Liquid Immersion Temperature:

Manufacturer	ACI or Equal
Model	TS-21XX-MH-10-AA
Thermowell	A/MXX (machined stainless steel)
Calibration Adjustments	N/A
Temperature monitoring range	32°F to 158°F
Output signal	Changing resistance (10K Ω)
Accuracy at Calibration point	$\pm 0.36^\circ\text{F}$ (+/- 0.2°C)

3. Duct Averaging Temperature:

Manufacturer	ACI or Equal
Model	TS-50XX-XD-10-AB (6', 12', or 24')
Calibration Adjustments	N/A
Temperature monitoring range	32°F to 158°F
Output signal	Changing resistance (10K Ω)
Accuracy at Calibration point	$\pm 0.36^\circ\text{F}$ (+/- 0.2°C)

4. Outside air temperature:

Manufacturer	Dwyer or Equal
Model	TE-RND-B
Calibration Adjustments	N/A
Temperature monitoring range	0°F to 150°F
Output signal	Changing resistance (10K Ω)
Accuracy at Calibration point	$\pm 0.4^\circ\text{F}$ (+/- 0.22°C)

E. Pressure & Differential Pressure Sensors

1. Liquid Pressure and Differential Pressure Transmitters

Manufacturer	Veris, ACI or Equal
Model	PW2 / A/WPR2-100 or Equal
Enclosure	NEMA4
Output	4 – 20 mA
Calibration Adjustments	Zero
Accuracy	$\pm 1\%$ Full Scale

2. Air Differential Pressure Transmitters (Low Range)
(Room Differential Pressure applications)

Manufacturer	Dwyer or Equal
Model	MS2-W111
Output	4 – 20 mA
Calibration Adjustments	Zero and span
Accuracy	$\pm 1\%$ Full Scale
With flush-mount wall plate with screened port	A-417 or A-465 or equal
Outdoor pick port shielded to minimize effects of wind gusts	A-306 or A-420 equal

3. Air Differential Pressure Transmitters (Low Range)
(Filter Differential Pressure/Duct Static Pressure)

Manufacturer	Dwyer or Equal
Model	MS2-W102
Output	4 – 20 mA
Calibration Adjustments	Zero and span
Accuracy	$\pm 1\%$ Full Scale
With pitot tip	A-302 or equal

F. Water Flow Meter

1. General

- a. Flow sensor and signal converter shall be sold as a package by the same manufacturer.
- b. Install with isolation valves immediately upstream and downstream of meter. If isolation valves are by others, DDC Contractor shall coordinate installation with installing Trade. If hot-tapping an operating hydronic system, provide hot-tap isolation valve instead.
- c. Install sensor in a location that provides sufficient lengths of straight pipe upstream and downstream of meter. Follow all manufacturer recommendations. If sufficient straight pipe is not available, notify Engineer of Record.
- d. All I/O points shown as hardwired on Building Automation Drawings must be hardwired. Points shown as networked may be transmitted as BACnet objects via network, or as hardwired I/O points.
- e. UL listed.

2. Magnetic, Insertion Type (High Accuracy)

- a. Application: required for all central plant applications, closed and open loop.
- b. Flow Sensor
 - 1) Insertion electromagnetic flow sensor
 - 2) Meter shall have at least two sets of electrodes, with the flow reading based on the average across all electrodes.
 - 3) Stainless steel or Hastelloy C electrodes
 - 4) No moving parts
- c. Signal Converter/Transmitter
 - 1) Adjustable zero and span
 - 2) Hardwired I/O (where required, see control schematics): 0-10 V or 4-20 mA output for flow
- d. Performance
 - 1) Flow velocity range: 0.1 – 20 FPS
 - 2) Accuracy shall be $\pm 1\%$ of actual reading from 2 to 20 FPS flow velocity.
 - 3) Accuracy shall be maintained over a turndown ratio of at least 200:1.
 - 4) NIST traceable factory calibration performed on accredited water flow test rig.
- e. Manufacturers: Onicon F-3500 or equal

3. Ultrasonic, Inline (High Accuracy)

- a. Application: for pipe diameters too small to accommodate insertion magnetic.
- b. Flow Sensor
 - 1) Ultrasonic type measuring flow by differential transit time
 - 2) Measurement by wetted direct-beam path. Clamp-on or indirect measurement is not acceptable.
 - 3) Range suitable for application and design flows
 - 4) Maximum 1.5 PSI pressure drop at design flow
 - 5) Flanged connections for pipe over 2" diameter; threaded connections acceptable for 2" diameter or less.
 - 6) All wetted parts shall be brass or stainless steel.
 - 7) No moving parts
- c. Signal Converter/Transmitter

- 1) Provide four-wire, externally powered transmitter with adjustable zero and span.
 - 2) Hardwired I/O (if required): Flow signal shall be a digital pulse proportional to the flow rate (to provide maximum accuracy and to handle abrupt changes in flow).
 4. Performance:
 - a. $\pm 1\%$ of reading over 25:1 turndown
 - b. $\pm 2\%$ of reading over 100:1 turndown
 - c. Minimum measurable flow: 500:1 turndown
 - d. Repeatability: $\leq \pm 0.2\%$
 - e. NIST traceable factory calibration performed on accredited water flow test rig.
 - f. Manufacturers: Onicon F-4600 and no known equal
 5. Turbine Type
 - a. Sensor Type:
 - 1) For pipes 1" diameter and smaller: Inline turbine
 - 2) For pipes 1.25" to 2" diameter: Single axial turbine.
 - 3) For pipes 2.5" and larger diameter: Dual counter-rotating axial turbines. Each turbine element shall have its own rotational sensing system, and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion.
 - b. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag.
 - c. Include 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown.
 - d. Sensing method shall be impedance sensing (non-magnetic and non-photoelectric)
 - e. Volumetric accuracy
 - 1) $\pm 0.5\%$ of reading at calibrated velocity
 - 2) $\pm 1\%$ of reading from 3 to 30 FPS (10:1 range)
 - 3) $\pm 2\%$ of reading from 0.4 to 20 FPS (50:1 range)
 - f. Each sensor shall be individually factory calibrated and tagged accordingly against the manufacturer's primary standards which must be accurate to within 0.1% and traceable to the U.S. National Institute of Standards and Technology (NIST).
 - g. Maximum operating pressure of 400 psi and maximum operating temperature of 180°F continuous (200°F peak).
 - h. All wetted metal parts shall be constructed of 316 stainless steel.
 - i. Analog outputs shall be 0-10V or 4-20mA, linear within 0.1% of span, with non-interactive zero and span adjustments.
 - j. Manufacturers: Onicon
 - 1) Single turbine: F-1100 Series
 - 2) Dual turbine: F-1200 Series
 - 3) Inline turbine: F-1300 Series
 - 4) Or Equal
- G. Switches and Status Indicators
 1. Differential Pressure Switch
 - a. Diaphragm with adjustable setpoint and adjustable differential.
 - b. Snap-acting Form C contacts rated for the application.
 - c. For water, switch must tolerate differential pressure up to 60 PSI.
 - d. For air, provide with manufacturer's recommended static pressure sensing tips.
 - e. Provide with status indicator point to BAS.
 2. Current Switch
 - a. Solid-core or split-core
 - b. Range as required by application
 - c. Adjustable trip point
 - d. Switch:

- 1) Solid state
 - 2) Normally open
 - 3) Relay output: minimum 120 VAC or VDC, 0.3 Amps.
 - 4) Zero off state leakage
 - e. Low Frequency Limit: 6 Hz
 - f. LED trip indicator
 - g. UL and CSA approved
 - h. May be used to start other devices if so indicated on Building Automation Drawings.
 - i. Manufacturers Veris Industries or Equal
 3. Occupancy Sensor
 - a. Ceiling mount passive infrared occupancy sensor
 - b. Sensor shall be mounted as indicated on the approved drawings.
 - c. Sensor output shall be accessible by EMS or HVAC system.
 - d. Time delay adjustment from 30 seconds to 30 minutes.
 - e. Operates at 24 VAC or 24 VDC +/-10%
 - f. UL and cUL Listed
 - g. EnOcean wireless or hardwired are acceptable.
- H. Control Relays
1. All control relays shall be UL listed, enclosed, with LED energized indicator.
 2. All relays shall have contact rating, configuration and coil voltage suitable for the application.
 3. Control relays for use on electrical systems of 120 volts or less shall have, as a minimum, the following:
 - a. AC coil pull-in voltage range of +10%, -15% or nominal voltage.
 - b. Coil sealed volt-amperes (VA) not greater than 4 VA.
 - c. Pilot light indication of power-to-coil and coil retainer clips.
 4. Relays used for across-the-line control (start/stop) of 120V motors, 1/4 HP, and 1/3 HP, shall be rated to break minimum 10 Amps inductive load.
 5. Relays used for stop/start control shall have low voltage coils (30 VAC or less), and shall be provided with transient and surge suppression devices at the controller interface.
 6. Manufacturer: Functional Devices RIB, Veris, Idec or Equal

2.7 ELECTRONIC ACTUATORS AND VALVES

- A. Quality Assurance for Actuators and Valves
1. UL Listed Standard 873 and C.S.A. Class 4813 02 certified.
 2. NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mounting.
 3. Five-year manufacturer's warranty. Two-year unconditional and three-year product defect from date of installation.
- B. Execution Details for Actuators and Valves
1. VAV box damper and reheat valve actuation shall be floating type or analog (2–10 VDC, 4–20 mA).
 2. Fan Coil Unit, Radiators and other terminal devices may be floating type or analog (2-10 VDC, 4-20 mA).
 3. Modulating Valve and Actuator control on Air Handling Units shall be analog (2–10 VDC, 4–20 mA).
- C. Actuators for damper and control valves 0.5–6 inches shall be electric unless otherwise specified, provide actuators as follows:
1. UL Listed Standard 873 and Canadian Standards Association Class 481302 shall certify actuators.

2. NEMA 2 rated actuator enclosures for inside mounting. Use additional weather shield to protect actuator when mounted outside.
 3. Five-year manufacturer's warranty. Two-year unconditional and three-year product defect from date of installation.
 4. Fail safe shall be provided when specified. Capacitors or spring return.
 5. Position indicator device shall be installed and made visible to the exposed side of the actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the actuator.
 6. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for butterfly valve actuators.
 7. A pushbutton gearbox release shall be provided for all non-spring actuators.
 8. Modulating actuators shall be 24 VAC and consume 10 VA power or less.
 9. Conduit connectors are required when specified and when code requires it.
- D. Damper Actuators
1. Air Handler Economizer actuators shall utilize analog control 2–10 VDC; floating control is not acceptable.
 2. Electric damper actuators (including VAV box actuators) shall be direct shaft-mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or set-screw type fasteners are not acceptable.
 3. Size actuators for sufficient torque for damper area. Small outside air and return air economizer damper sections may be mechanically linked together if one (1) actuator has sufficient torque to drive both and damper drive shafts are both horizontal installed.
- E. Valve Actuators 0.5–6 inches
1. All zone service actuators shall be non-spring return unless otherwise specified.
 2. The valve actuator shall be capable of providing the minimum torque required for proper valve close-off for the required application.
 3. All control valves actuators shall have an attached 3-foot cable for easy installation to a junction box.
 4. Override handle and gearbox release shall be provided for all non-spring return valve actuators.
- F. Control Valves 0.5–6 inches
1. The BAS contractor shall furnish all specified motorized control valves and actuators. BAS contractor shall furnish all control wiring to actuators. The plumbing contractor shall install all valves. Equal percentage control characteristic shall be provided for all water coil control valves. Linear valve characteristic is acceptable for 3-way valves that are 2.5 inches and above.
 2. Characterized control valves shall be used for hydronic heating or cooling applications and small to medium AHU water-coil applications to 100GPM. Actuators are non-spring return for terminal unit coil control unless otherwise noted. If the coil is exposed to the outside air stream, see plans for spring return requirement.
 - a. Leakage is 0% (zero percent), close-off is 200psi, maximum differential is 30psi.
 - b. Valves 0.5–2 inches shall be nickel-plated forged brass body, NPT screw type connections.
 - c. Valves 0.5–1 inches shall be rated for working pressure of 600 PSI. Valves 1.25–2 inches shall be rated for working pressure of 500 PSI.
 - d. The operating temperature range shall be 0–250 degrees F.
 - e. Valves 1–2 inches shall be stainless steel ball and stem. Valves below 1 inch shall be stainless steel ball and stem if required by the application or by customer standard.
 - f. Seats shall be fiberglass reinforced Teflon.

- g. Two-way and three-way valves shall have an equal percentage control port. Full stem rotation is required for maximum flow to insure stable BTU control of the coil.
 - h. Three-way valve shall be applicable for both mixing and diverting.
 - i. The characterizing disc is made of TEFZEL and shall be keyed and held secure by a retaining ring.
 - j. The valves shall have a blow-out proof stem design.
 - k. The stem packing shall consist of two (2) lubricated O-rings designed for on-off or modulating service and require no maintenance.
 - l. The valves shall have an ISO type, 4-bolt flange for mounting actuator in any orientation parallel or perpendicular to the pipe.
 - m. A non-metallic thermal isolation adapter shall separate valve flange from actuator.
 - n. One (1) fastening screw shall secure the direct coupling of the thermal isolation adapter between the actuator and the valve. This will prevent all lateral or rotational forces from affecting the stem and its packing O-rings.
- 3. Globe valves 0.5–2 inches shall be used for steam control or water flow applications.
 - a. Valves shall be bronze body, NPT screw type, and shall be rated for ANSI Class 250 working pressure.
 - b. Valves 0.5 inches (DN15) through 2 inches (DN50) with spring return actuators shall close off against 50 psi pressure differential with Class III leakage (0.1%).
 - c. The operating temperature range shall be 20–280 degrees F.
 - d. Spring loaded TFE packing shall protect against leakage at the stem.
 - e. Two-way valves shall have an equal percentage control port.
 - f. Three-way valves shall have a linear control and bypass port.
 - g. Mixing and diverting valves must be installed specific to the valve design.
- 4. Globe Valves 2.5–6 inches
 - a. Valves 2.5 inches (DN65) through 6 inches (DN50) shall be iron body, 125 lb. flanged piping connection, body pressure rating consistent with ANSI 125, and Class III (0.1%) close-off leakage at 50 psi differential.
 - b. Valves with spring return actuators shall close off against 50 psi pressure differential with Class III leakage (0.1%).
 - c. Flow type for two-way valves shall be equal percentage. Flow type for three-way valves shall be linear.
 - d. Mixing and diverting valves must be installed specific to the valve design.
- G. Butterfly valves
 - 1. Butterfly valves shall be sized for modulating service at 60–70 degree stem rotation. Isolation valves shall be line-size. Design velocity shall be less than 12 feet per second when used with standard EPDM seats.
 - a. Body is cast iron with powder coat finish.
 - b. Disc is 304 stainless steel.
 - c. Seat is EPDM standard.
 - d. Body Pressure is consistent with ANSI class 125 (200 PSI for valves 1-12 inches at -20–150 degrees F. Different body pressure for larger valves and/or at higher temperatures).
 - e. Flange is ANSI 125/250.
 - f. Media Temperature Range is -22–250 degrees F.
 - g. Maximum Differential Pressure is 200 psi for 2- to 6- inch size.
- H. Butterfly Valve Industrial Actuators
 - 1. Actuators shall be approved under Canadian Standards Association or other Nationally Recognized Testing Laboratory to UL standards. CSA Class 4813 02 or equal. Enclosure shall be NEMA 4 (weatherproof) enclosure and will have an industrial quality coating.

- a. Actuator shall have a motor rated for continuous duty. The motor shall be fractional horsepower; permanent split capacitor type designed to operate on a 120 VAC, 1pH, 60 Hz supply. Two (2) adjustable cam-actuated end travel limit switches shall be provided to control direction of travel. A self-resetting thermal switch shall be imbedded in the motor for overload protection.
 - b. Reduction gearing shall be designed to withstand the actual motor stall torque. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.
 - c. Actuator shall be equipped with a detachable hand crank or hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction.
 - d. The actuator shall be analog, floating, or two position as called out in the control sequence of operation. All Analog valves shall be positive positioning, and respond to a 2–10 VDC, 4-20 mA, or adjustable signal as required. Analog actuators shall have a digital control card allowing any voltage input for control and any DC voltage feedback signal for position indication.
 2. Actuator mounting for damper and valve arrangements shall comply with the following:
 - a. Damper actuators: Shall not be installed in the air stream if possible.
 - b. A weather shield shall be used if actuators are located outside.
 - c. Damper or valve actuator ambient temperature shall not exceed 122 degrees F through any combination of medium temperature or surrounding air. Appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation shall be provided as necessary.
 - d. Actuator cords or conduit shall incorporate a drip leg if condensation is possible. Water shall not be allowed to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point shall be avoided to prevent water from condensing in conduit and running into actuator.
 - e. Damper mounting arrangements shall comply to the following:
 - 1) The ventilation subcontractor shall furnish and install damper channel supports and sheet metal collars.
 - 2) Jack shafting of damper sections is be allowed as long as the total combined section does not exceed 50 ft2
 - f. Multiple section dampers of two or more shall be arranged to allow actuators to be direct shaft mounted on the outside of the duct.
 3. Valve Sizing for Water Coil
 - a. On/Off control valves shall be line-size.
 - b. Modulating control valve body size may be reduced, at most, two (2) pipe sizes from the line size or not less than half the pipe size. The BAS contractor shall size all water coil control valves for the application as follows:
 - 1) Booster-heat valves shall be sized not to exceed 4–9psi differential pressure. Size valve for 50% valve authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.
 - 2) Primary valves shall be sized not to exceed 5–15psi differential pressure. Size valve for 50% valve authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.
 - 3) Butterfly valves shall be sized for modulating service at 60–70 degree rotation. Design velocity shall be 12 feet per second or less when used with standard EPDM seats.
 - c. Valve mounting arrangements shall comply with the following:
 - 1) Unions shall be provided on all ports of two-way and three-way valves.
 - 2) Install three-way equal percentage characterized control valves in a mixing configuration with the “A” port piped to the coil.
 - 3) Install 2.5 inches and above, three-way globe valves, as manufactured for mixing or diverting service to the coil.
- I. Pressure-Independent Ball Valves NPS 6 and Smaller:

1. Performance:
 - a. Pressure Rating for NPS 2 and smaller: 360 psig.
 - b. Pressure Rating for NPS 2-1/2 through NPS 6: ANSI 125, Class B.
 - c. Close-off pressure for NPS 2 and smaller: 200 psi.
 - d. Close-off pressure for NPS 2-1/2 through NPS 6: 100 psig.
 - e. Process Temperature Range: Between 14 deg F to 250 deg F.
2. Body: NPS 2 and smaller Forged brass, nickel plated with NPT female ends.
3. Body: NPS 2-1/2 through NPS 6 Cast iron with pattern to mate with ANSI 125 flange.
4. Ball: Stainless steel.
5. Stem and Stem Extension: Stainless steel, blowout-proof design.
6. Ball Seats: Teflon PTFE.
7. Stem Seal: Dual EPDM O-rings (lubricated).
8. Flow Characteristic: Equal percentage.
9. Flow Meter: A characterized control valve shall be integrated with an ultrasonic flow sensor (accuracy +/- 2%) providing analog flow feedback. The valve shall reposition to maintain the required flow with a +/- 5% accuracy over a pressure differential range of 1 to 50 psig.
10. Glycol Compensation: The control valve assembly shall incorporate an algorithm to automatically compensate for the glycol concentration and be readable by a local device.

2.8 DAMPERS

- 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 (1/8 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·m² (10 cfm per ft²) 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.

2.9 ENCLOSURES

- A. All controllers, power supplies and relays shall be mounted in enclosures.
- B. Interior enclosures shall be NEMA1, exterior enclosures shall be NEMA3R.
- C. Enclosures shall have hinged, locking doors.

- D. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 1/8" thick sized appropriately to make label easy to read.
- E. All temperature control panels shall be fabricated in a UL-listed panel shop. Field assembled temperature control panels are not allowed.

2.10 POWER SUPPLIES AND CONTROL TRANSFORMERS

- A. Basis of design PSH500 from functional devices.
- B. Provide 120V plug receptacle in all panels with terminal unit routers.
- C. Control transformers and power supplies shall be UL-Listed.
- D. Provide Class 2 current-limiting type or over-current protection in both primary and secondary circuits for Class 2 service per NEC requirements.
 - 1. Transformer shall be properly sized for application. Limit connected loads to 80% of rated capacity.
 - 2. Line voltage units shall be UL Recognized and CSA Approved.
- E. DC Power Supplies: DC power supply output shall match output current and voltage requirements. Power supply shall be full-wave rectified type with the following minimum Specifications:
 - 1. Built-in overvoltage and overcurrent protection and able to withstand a 150% current overload for a minimum of three (3) seconds without tripping or failure.
- F. Emergency Stop Switch: Red, mushroom type, pull out to operate.
- G. End Switches: Turret head type SPDT. Square D Class 9007, Type C54B2, or equal.

2.11 OPERATOR INTERFACE SYSTEM

- A. Operator Workstation: Provide personal computer that performs all data access, operator's commands, alarm management, requests for reports, file generation, diagnostics, and modifications. Control system shall not be dependent on Operator Workstation for operation. Computer to be used for operator interface.
 - 1. CPU: Windows compatible computer using current microprocessor technology operating at minimum of 2.8 GHz with 512 MB RAM.
 - 2. Display Unit: Minimum 17-inch (nominal) flat screen color monitor, supporting a minimum display resolution of 1280x1024 pixels, with separate controls for color contrast and brightness, and non-reflective screen.
 - 3. Video Card: Minimum 64 MB RAM capable of supporting a minimum of 1280x1024 resolution with a minimum of 32 Bit color.
 - 4. Drives: Minimum 120 G byte hard disc, CD Read/Write, DVD player.
 - 5. Alphanumeric Keyboard and Mouse: Provide an alphanumeric keyboard with standard 96 character ASCII set output. Provide a "mouse" input device with pad.
 - 6. Printers: System printers are to be of the color ink jet type operating under software control as specified in the software section of this specification.
 - 7. Operating System: Windows XP, 2000 or comparable.

- B. Web Based Access: Provide a web-based controls interface with at least 3 user login accounts and password each with the capability of different access privileges that performs all data access, operator's commands, alarm notification, requests for reports, file generation, diagnostics, and modifications. Controls shall also be accessible in mechanical room by direct connection from a laptop to a data port. The contractor shall provide a temporary computer located on site in the mechanical room until the commissioning, testing and balancing has been completed. The Contractor shall provide a temporary computer located on site in the mechanical room, with all software and capabilities necessary to support commissioning, testing and balancing and other activities required for project completion.
- C. Graphics: Provide a complete graphics package with the following features:
1. Provide separate schematic diagram depicting each system. Diagrams to show all major components such as fans, dampers, heating and cooling coils, humidifiers, pumps, heat exchangers, chillers, boilers, towers, ductwork, piping, etc. arranged to convey to viewer system configuration and flow of each system.
 2. Provide plot plan, riser plan and selected floor plans of all buildings with the location of each mechanical room and major equipment location indicated.
 3. Provide symbols superimposed on each schematic to indicate each control device including control valves, damper motors, temperature sensors, pressure sensors, etc. Provide real time dynamic displays of the temperature, humidity, pressure, flow rate, run status, alarm status etc. adjacent to each control symbol. Arrange CPU to update each displayed analog and digital value minimum of every 15 seconds.
 4. Provide indication of all setpoints, with each setpoint value located adjacent to each sensed value.
 5. Provide means to allow the user to easily change or add graphics via computer assisted drawing function utilizing freehand mouse.
 6. Provide means to allow user to transfer repeated system schematics and symbols between graphics without redrawing them. Provide symbol library arranged to store all commonly used symbols.
 7. Provide a "telescoping" or "zoom" program to allow use to move from plot plan to mechanical room plan, to system graphic to control device display by simply clicking the mouse.
 8. Provide dual function windowing program to allow user to view a split screen and toggle between simultaneous operations.
- D. Trend Data Collection and Historical Data:
1. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-intervals, time-synchronized intervals, change of value, or by-event all of which shall be user-definable. Trend data shall be collected stored on hard disk for future diagnostics and reporting. Automatic Trend collection may be scheduled of zones, events, and reports. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.
 2. Trend data reports shall be provided to allow the user to view all trended point data. Display data in both tabular and graphical format. Reports may be customized to include individual points or predefined groups of selected points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel.

2.12 APPLICATION PROGRAMS

- A. General: Provide user-programmable DDC system programs with library of base-level predefined functions with user specified parameters.
- B. Time of Day Scheduling:
1. A minimum of 6 schedules shall be provided for equipment operation.

2. Seven unique days per schedule shall be provided.
 3. Program individual time cycle capability for each piece of equipment.
- C. Control Priorities:
1. The system shall provide an effective order of control priorities such that each succeeding level of optimization does not interfere with a more critical function.
 2. This shall allow such features as alarm actions and manual commands from the operator to override lower level functions (such as duty cycling or scheduling).
 3. Events, initiated outside the DDC system causing equipment shutdown shall automatically reset when events causing the shutdown is cleared, such as power failure or fire alarm. (When Fire Alarm system is cleared and reset, air handlers, etc. shall sequentially restart). For alarms within the control system, such as freeze protection, mechanical equipment such as air handlers, shall restart after the alarm condition is manually reset.
- D. Alarms: System shall provide following alarm processing capabilities:
1. Any connected status or analog point may be designated as alarm input point.
 2. Start/stop points with status feedback as well as associated analog alarms shall have a user-programmable inhibit time assigned to each point to prevent nuisance alarms from occurring during startup of HVAC equipment.
 3. Each alarmable point shall have change-of-state priority assignment assignable at 3 levels. One each for its level of criticality -- low for such things as maintenance alarms, high for critical HVAC equipment alarms and emergency for life safety alarms.
 4. User may designate which conditions of alarm shall cause alarms to be initiated for display. The user may also designate alarm message for alarm condition and for return to normal condition as desired. Each message may be up to 32 characters in length and up to 32 messages are available in each digital management system.
 5. This feature shall provide for orderly display of alarms based on criticality, i.e., if two or more alarms occur simultaneously, alarm with highest level of priority shall be displayed first.
 6. User may designate which conditions of alarm shall cause alarms to be initiated for display. User may also designate alarm message for alarm condition and for return to normal condition as desired. Each message may be up to 80 characters in length.
 7. Provide automatic phone dialing feature with the capability to report a general alarm recorded message.
- E. Security: System shall support multi-level password access with the following minimum access levels:
1. Read-only level, without capability of changing any part of software.
 2. Adjustment level, allowing operator to adjust setpoints and schedules, force outputs on/off, but not to modify programming.
 3. Full programming access.
 4. System shall support additional levels of programming access.
- F. Power Failure: In the event of the loss of normal power, there shall be an orderly shutdown of all controllers to prevent the loss of database or operating system software. Nonvolatile memory shall be incorporated for all critical controller configuration data, and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
1. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions.
 2. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
 3. Should a controller memory be lost for any reason the operator workstation shall automatically reload the program without any intervention by the system operators.

2.13 INPUT/OUTPUT (I/O) FUNCTIONS

- A. Analog Inputs (AI): The AI function shall monitor each analog input, perform A-to-D conversion, and hold the digital value in a buffer for interrogation. Provide signal conditioning for each analog input. Individually calibrate all analog inputs for zero and span, in hardware or in software. Minimum 12 bit A to D resolution.
- B. Analog Outputs (AO): The AO function shall accept digital data, perform D-to-A conversion, and output a signal compatible with the operator. Individually calibrate all analog outputs for zero and span. Provide short circuit protection. Minimum 8 bit D to A resolution.
- C. Digital Inputs (DI): The DI function shall accept on/off, open/close, or other change of state (two-state data) indications. Provide isolation and protection against input voltage up to 180 Vac peak.
- D. Digital Outputs (DO): The DO function shall provide contact closures for momentary and maintained operation of output devices. Closures shall have a minimum duration of 0.1 second.

2.14 UPS PRODUCT SPECIFICATIONS

- A. General: Provide an uninterruptable power supply (UPS) for each DDC field panel. The UPS shall be fed by 120V AC emergency power circuits. The UPS shall be floor or wall mountable.
- B. UPS: Provide MGE Pulsar UPS, or pre-bid approved equal. Products shall carry UL 1778 listing. Base sizing on peak current requirements of connected load, plus 15 percent factor of safety. Provide manufacturer's standard three-year comprehensive warranty, including batteries.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. CRT, Keyboard, Computer, and Printers: Locate as shown or submit proposed location where not shown.
- B. Mounting Panels: Locate panels where shown on Drawings or near item of equipment to be controlled, but not on equipment itself.
- C. DDC Field Panels: Provide number of panels required to accommodate all DI, DO, AI, and AO points and all hardware and software to accomplish specified control sequenced. Locate all panels in mechanical or electrical rooms. Submit proposed locations for approval prior to preparing control drawings.
- D. Electrical:
 - 1. Provide control wiring for all control devices and control panels.
 - 2. [Run all control wiring in conduit.] [Run all control wiring in mechanical rooms or locations susceptible to damage in conduit. Plenum rated cable may be used in other locations.]
 - 3. Provide power wiring for all control devices and control panels. Utilized designated circuits in electrical power panels. Refer to Electrical Drawings. If no circuits are designated for DDC Controls, submit detailed request for use of spare circuits at no additional cost.
 - 4. All power wiring to be installed in conduit.

5. Grounding: Instrumentation and communication grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.
 6. Control voltage shall be limited to maximum of 120 volts.
 7. Where relay coil is connected to load side of motor starter to energize with motor operation, external control circuit shall be properly fused with fuse block located in respective starter enclosure.
 8. Where relays are used to control single phase motors directly, provide contacts rated for not less than horsepower rating of largest motor switched by relay.
- E. Identification: Provide engraved nameplates identifying all switches, lights and starters, and each control device where control function is not readily apparent.
- F. Room Thermostats and Room Sensors: Mount at height of 4 feet for wall mounted sensor and thermostats with adjustment on face. Mount at height of 5 feet for all wall mounted thermostats and sensors which do not have adjustment on face. Provide insulating back on thermostats mounted on exterior walls. Provide one thermostat for each zone of temperature control. Submit proposed locations for approval prior to preparing control drawings, where not shown or alternate location is proposed.
- G. Carbon Dioxide Sensor:
1. Mount sensor at 5 feet above finished floor or as indicated on the plans.
 2. Provide sensor quantity as indicated on plans or as required by sensor coverage rating (max. 20-foot radius).
 3. Alarm above 850 PPM.
 4. Refer to sequence of operations for more information on sensor use.
- H. Water Flow Meters: Install devices in accordance with the manufacturer's recommendations, with sufficient upstream and downstream straight pipe to obtain accurate readings.
- I. Leak Detection System: Refer to Drawings for required locations and extent of area to be covered. Install in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 23 09 93

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 AIR HANDLING UNIT VARIABLE AIR VOLUME (AHU-VAV) WITH MINIMUM OSA

- A. System Overview
 - 1. Each AHU unit will be directly controlled by its own dedicated EMS (Energy Management System) unitary controller.
- B. Unit Fan Operation
 - 1. When the AHU is in Occupied Mode or in Afterhours Mode, the supply fan shall run continuously and the Minimum OSA damper shall be commanded open.
 - 2. During the Unoccupied Mode as determined by EMS time schedule, the AHU is enabled with demand from the VAV zones and the zone temperatures are controlled by the VAV zone unoccupied space temperature heating and cooling setpoints.
- C. Duct Static Pressure Reset
 - 1. A duct static pressure transducer shall be provided with the sensor located at approximately two-thirds of the distance of the total supply duct length.
 - 2. The supply fan speed shall be varied as required to maintain the supply fan duct static pressure setpoint.
 - 3. In Manual Mode, the duct static pressure setpoint can be set by the system operator at the Operator Workstation (OWS) manually. Initial setpoint is 1.5" W.C. (adjustable).
 - 4. In Auto-Reset Mode, the duct static pressure setpoint is varied by the EMS unitary controller between specified limits in response to the VAV boxes' "need more air" signals.
- D. Building Static Pressure Reset
 - 1. The AHU return/exhaust fan VFD speed shall be varied as required to maintain building static pressure setpoint 0.05 in W.C. (adjustable) as set by the system operator at OWS.
- E. Supply Air Temperature Reset
 - 1. The supply air temperature setpoint can be set by the system operator at OWS in either Manual Mode or Auto-Reset Mode.
 - 2. In Auto-Reset Mode, the EMS unitary controller resets the supply air temperature between 55°F to 65°F based on actual building load as determined by the VAV boxes' need-cooling signals.
- F. Minimum Outdoor Air Control
 - 1. During Occupied Mode or Afterhours Mode, the economizer damper(s) shall be commanded by the EMS unitary controller to maintain a position which satisfies the Minimum Outdoor Air ventilation requirements for the VAV zones. Damper position(s) determined by Air Balancing Contractor.
 - 2. Monitor Min OSA CFM via Air Flow Measuring Station to maintain Min OSA CFM setpoint.
- G. Pre-Occupancy Purge
 - 1. The EMS shall schedule the AHU to be in Occupied Mode one hour prior to the actual time of anticipated occupancy.

- H. Cooling operation
 - 1. The EMS unitary controller compares the outside air temperature with the supply air temperature setpoint and determines a need-cooling control signal.
 - 2. The first stage of cooling will enable the economizer to provide free cooling for as long as possible.
 - 3. The second stage will modulate the CHW cooling coil control valve to maintain the supply air temperature setpoint.
 - 4. Mechanical heating to be locked out during cooling mode.
- I. Smoke Detector
 - 1. When particles of combustion are detected in the supply air stream by the AHU smoke detector (furnished/installed by others), the AHU shall shut down via hardwire interlock.
- J. Fault Detection Diagnostics
 - 1. The EMS DDC Controller shall monitor the following economizer actuator Fault Detection Diagnostic conditions and broadcast results via EMS network:
 - 2. Temperature Sensor Failure/Fault
 - 3. Economizer not economizing when enabled
 - 4. Economizer economizing when disabled
 - 5. Economizer damper modulation fault
 - 6. Excess outdoor air
- K. Monitoring - The following conditions shall be monitored and displayed at EMS OWS:
 - 1. System graphics showing dynamic status of all points.
 - 2. Start/Stop – supply and return/exhaust fans.
 - 3. Fan Fault & Alarm Status – supply and return/exhaust fan VFD interface.
 - 4. Minimum outside air damper signal setpoint (OAD Min)
 - 5. Minimum outside air CFM
 - 6. Supply, Return, Mixed and Outside air temperatures.
 - 7. Supply air temperature setpoint (adjustable).
 - 8. Duct static pressure setpoint (adjustable).
 - 9. Building static pressure setpoint (adjustable)
 - 10. Filter static pressure alarm setpoint (adjustable)
 - 11. Economizer damper actuators feedback (% open)
 - 12. Runtime total for fans operation up to 64,000 hours.
 - 13. Alarms (temperature, status, pressure).
 - 14. Warm up/Cooling mode/Night setback - Status of zone operation.

1.2 VARIABLE PRIMARY CHILLED/HOT WATER SYSTEM

- A. The heat pump and associated pumps are controlled by the DDC system.
- B. The isolation valve associated with each heat pump will be commanded open with corresponding feedback status confirmed before any heat pump receives a start signal.
- C. Start the pump when the heat pump is commanded to start or generates a start signal. Should the pump fail as monitored by EMS current transducer, generate an alarm at the operator's workstation (OWS) terminal.
- D. The water supply setpoint is set at the operator's terminal. The DDC system shall monitor the water supply and return temperatures.
- E. The primary chilled water pumps associated with each chiller will start when that chiller receives a start signal.

- F. The heat pumps internal controls will maintain the water temperature based on the reset signal sent from the DDC system. DDC system shall monitor the water supply and return temperatures and stage on the heat pumps when the pump is proven on.
- G. The water pumps will start <through the time schedule program><when the outside air temperature is above 65 deg. F. and 20% (adjustable) of water valves are calling for cooling.> The status of the pumps will be provided through monitoring of VFD alarm at each pump.
- H. The VFD on the pumps will modulate to maintain a constant differential pressure setpoint (adjustable) across leaving and entering water lines and maintain the manufacturer's minimum and maximum flow through the heat pumps. If the VFDs are at minimum speed, the water bypass valve will start to modulate open to maintain the water system differential pressure.
- I. Provide a lead-lag algorithm for units having multiple pumps. Should the lead pump fail when commanded on, an alarm will be indicated, and the lag pump will start automatically.
- J. The DDC system will stage heat pumps on and off always using the fewest number of heat pumps possible to maintain set point.
- K. The following displays/commands to be available at terminal:
 - 1. Alarm from each heat pump as inputs.
 - 2. Current status commanded heat pumps and pumps.
 - 3. Primary supply and return water temperature.
 - 4. Secondary supply and return water temperature.
 - 5. Leaving heat pump temperature setpoint.
 - 6. Differential pressure setpoint across heat pumps.
 - 7. Heat pump alarm status via control panel BACnet interface.
 - 8. Current switch at each pump.
 - 9. Pump and heat pump runtime totalization (up to 64,000 hours).
 - 10. Trend logs.
 - 11. Alarm history.
 - 12. Lead pump indication.

1.3 FAN COIL OPERATION

- A. EMS Unitary controller shall send timeclock signal to start/stop Split System Fan Coil Unit.
- B. operate under its own control to maintain room temperature setpoint as determined by wall mounted programmable thermostat.
- C. Monitoring - The following conditions shall be monitored by the EMS:
 - 1. Zone temperature.
 - 2. Alarm – If the zone temp exceeds 80°F (adjustable), an alarm shall be displayed and annunciated at the operator's console.

1.4 FAN COIL OPERATION

- A. EMS Unitary controller shall send timeclock signal to start/stop Split System Fan Coil Unit.
- B. The Fan Coil will operate under its own control to maintain room temperature setpoint as determined by wall mounted programmable thermostat.
- C. Monitoring - The following conditions shall be monitored by the EMS:
 - 1. Zone temperature.

2. Alarm – If the zone temp exceeds 80°F (adjustable), an alarm shall be displayed and annunciated at the operator's console.
- 1.5 HEAT PUMP UNIT WITH ECONOMIZER, DEMAND CONTROL VENTILATION & ZONE OCCUPANCY MONITORING
- A. System Overview
 1. Each Heat Pump unit will be directly controlled by its own dedicated EMS (Energy Management System) unitary controller.
 2. EMS unitary controller will be connected to a wall mounted electronic zone temperature sensor with integral relative humidity sensor and CO2 sensor.
 3. Electronic zone temperature sensor shall have a touch screen LCD interface which includes: 1) digital pushbuttons for warmer/cooler setpoint control; 2) visual display of room temperature, room humidity, room CO2 and ambient OSA temperature; and 3) digital pushbutton after-hours override timer control, with user adjustable duration. The after-hours override duration shall have the ability to be limited from the front-end.
 - B. Occupancy/Vacancy Monitoring
 1. Zone occupancy and vacancy will be actively monitored by connection to Lighting Control System occupancy sensor(s). If available, monitoring shall be accomplished via BACnet system integration. Otherwise, BAS contractor shall monitor auxiliary contacts on Lighting Control System occupancy sensor(s).
 - C. Unit Fan Operation
 1. When the zone is in Occupied Mode or in Afterhours Mode, the fan shall run continuously, unless Vacant Mode has been triggered.
 2. During the Unoccupied Mode as determined by EMS time schedule, the unit fan cycles with demand and the temperature is controlled by the unoccupied space temperature heating and cooling setpoints.
 - D. Minimum Outdoor Air Ventilation
 1. During Occupied Mode or Afterhours Mode, the economizer damper shall be commanded by the EMS unitary controller to maintain a position which satisfies the Minimum Outdoor Air ventilation requirements for the zone. Damper position(s) determined by Air Balancing Contractor.
 - E. Demand Control Ventilation
 1. EMS unitary controller will be connected to a wall mounted CO2 sensor to monitor zone CO2 concentration.
 2. During Occupied Mode or Afterhours Mode, the EMS unitary controller shall reset the outside air damper minimum position to maintain the CO2 concentration below 1,000 ppm.
 - F. Automatic Demand Reduction Controls
 1. EMS shall be programmed with capability to implement centralized demand shed for all non-critical zones upon call for Automatic Demand Reduction. Critical zones shall not be impacted by demand shed conservation measures.
 - G. Vacant Mode Control
 1. When the zone has been scheduled for occupancy for at least one hour and the occupancy sensor has confirmed that zone has been vacant for 5 minutes (adjustable: maximum 30 minutes), zone shall be placed into Vacant Mode.
 2. Reset cooling and heating setpoints up and down by 2°F (adjustable) or more.

3. Ventilation air in a Vacant zone shall be reduced to zero when permitted to do so according to California Title 24 Table 120.1A (all Occupancy Categories with Note "F" designation). The unit fan shall be shut off and the economizer shall be closed to the outside air. For all other zones, the economizer shall be set to Minimum Outdoor Air position and the unit fan shall operate to provide minimum ventilation during Vacant Mode.
 4. Upon detection of occupancy, Vacant Mode shall be cleared.
- H. Zone Pre-Occupancy Purge
1. The EMS shall schedule the zone to be in Occupied Mode one hour prior to the actual time of anticipated occupancy.
- I. Heating operation
1. The controller compares the heating setpoint with the space temperature and determines a need-heating control signal to engage the compressor and reversing valve (according to Heat Pump Unit manufacturer's instruction for heating cycle) to maintain the room set point.
 2. If further heating is required after compressor/reversing valve heating is active for 15 minutes (adjustable), engage auxiliary electric heat.
 3. Economizer to be commanded to Min CFM setpoint during heating mode.
- J. Cooling operation
1. The controller compares the cooling setpoint with the space temperature and determines a need-cooling signal.
 2. The first stage of cooling will enable the economizer to provide free cooling for as long as possible.
 3. The second stage of cooling will enable the compressor and reversing valve (according to Heat Pump Unit manufacturer's instruction for cooling cycle) to maintain the room set point.
- K. Fault Detection Diagnostics
1. The EMS DDC Controller shall monitor the following economizer actuator Fault Detection Diagnostic conditions and broadcast results via EMS network:
 - a. Temperature Sensor Failure/Fault
 - b. Economizer not economizing when enabled
 - c. Economizer economizing when disabled
 - d. Economizer damper modulation failure
 - e. Excess outdoor air
- L. Monitoring - The following conditions shall be monitored and displayed at EMS Operator Workstation/Graphical User Interface:
1. Supply air temperature.
 2. Room temperature.
 3. Room humidity.
 4. Room CO2 concentration.
 5. Room occupancy status.
 6. Current mode (heating/cooling/fan).
 7. Supply air temperature attained last time unit was in heating.
 8. Supply air temperature attained last time unit was in cooling.
 9. Current command status of fan, compressor, reversing valve and aux heat.
 10. Run time meters on fan, compressor, reversing valve and aux heat.
 11. Fan Status thru Current Switch.
 12. Economizer actuator feedback status.
- 1.6 VRV ZONE UNIT WITH ECONOMIZER, DEMAND CONTROL VENTILATION, ZONE OCCUPANCY MONITORING & DOOR/WINDOW SWITCHES

- A. System Overview
 - 1. Each VRV fan coil unit will be directly controlled by its own dedicated factory-provided VRV fan coil controller and thermostat which serve to provide control of mechanical cooling/heating and fan ventilation in the zone. VRV equipment manufacturer is responsible for all internal sequence of operations programming logic and controls associated with the factory-provided VRV fan coil controller and thermostat.
 - 2. Energy Management System (EMS) unitary controller will be provided by EMS contractor to fully control zone economizer, monitor zone CO2 concentrations, zone occupancy conditions and door/window switch status conditions.
 - 3. EMS unitary controller shall be connected to a wall mounted CO2 sensor.
- B. Occupancy/Vacancy Monitoring
 - 1. Zone occupancy and vacancy will be actively monitored by connection to Lighting Control System occupancy sensor(s). If available, monitoring shall be accomplished via BACnet system integration. Otherwise, BAS contractor shall monitor auxiliary contacts on Lighting Control System occupancy sensor(s).
- C. Unit Fan Operation
 - 1. When the zone is in Occupied Mode or in Afterhours Mode, the fan shall run continuously, unless Vacant Mode has been triggered.
 - 2. During the Unoccupied Mode as determined by EMS time schedule, the unit fan cycles with demand and the temperature is controlled by the unoccupied space temperature heating and cooling setpoints.
- D. Minimum Outdoor Air Ventilation
 - 1. During Occupied Mode or Afterhours Mode, the economizer damper shall be commanded by the EMS unitary controller to maintain a position which satisfies the Minimum Outdoor Air ventilation requirements for the zone. Damper position(s) determined by Air Balancing Contractor.
- E. Demand Control Ventilation
 - 1. EMS unitary controller will be connected to a wall mounted CO2 sensor to monitor zone CO2 concentration.
 - 2. During Occupied Mode or Afterhours Mode, the EMS unitary controller shall reset the outside air damper minimum position to maintain the CO2 concentration below 1,000 ppm.
- F. Automatic Demand Reduction Controls
 - 1. EMS shall be programmed with capability to implement centralized demand shed for all non-critical zones upon call for Automatic Demand Reduction. Critical zones shall not be impacted by demand shed conservation measures.
- G. Vacant Mode Control
 - 1. When the zone has been scheduled for occupancy for at least one hour and the occupancy sensor has confirmed that zone has been vacant for 5 minutes (adjustable: maximum 30 minutes), zone shall be placed into Vacant Mode.
 - 2. Reset cooling and heating setpoints up and down by 2°F (adjustable) or more.
 - 3. Ventilation air in a Vacant zone shall be reduced to zero when permitted to do so according to California Title 24 Table 120.1A (all Occupancy Categories with Note "F" designation). The unit fan shall be shut off and the economizer shall be closed to the outside air. For all other zones, the economizer shall be set to Minimum Outdoor Air position and the unit fan shall operate to provide minimum ventilation during Vacant Mode.
 - 4. Upon detection of occupancy, Vacant Mode shall be cleared.
- H. Zone Pre-Occupancy Purge

1. The EMS shall schedule the zone to be in Occupied Mode one hour prior to the actual time of anticipated occupancy.
- I. Heating operation
 1. Economizer to be commanded to Min CFM setpoint during heating mode.
 2. Heating operation not allowed if door/window switches indicate OPEN for more than 5 minutes (adjustable).
- J. Cooling operation
 1. Economizer to be commanded to Max CFM setpoint during cooling mode, provided the Economizer Outside Air Lockout Setpoint threshold has not been surpassed.
 2. Mechanical cooling operation not allowed if door/window switches indicate OPEN for more than 5 minutes (adjustable).
- K. Motorized Relief Damper
 1. Motorized relief damper shall be commanded to open and close in tandem with VRV fan operations.
 2. Mechanical cooling operation not allowed if door/window switches indicate OPEN for more than 5 minutes (adjustable).
- L. Fault Detection Diagnostics
 1. The EMS DDC Controller shall monitor the following economizer actuator Fault Detection Diagnostic conditions and broadcast results via EMS network:
 - a. Temperature Sensor Failure/Fault
 - b. Economizer not economizing when enabled
 - c. Economizer economizing when disabled
 - d. Economizer damper modulation fault
 - e. Excess outdoor air
- M. Monitoring - The following conditions shall be monitored and displayed at EMS Operator Workstation/Graphical User Interface:
 1. Supply air temperature.
 2. Room temperature.
 3. Room CO2 concentration.
 4. Room occupancy status.
 5. Current mode (heating/cooling/fan).
 6. Economizer actuator feedback status.

END OF SECTION

SECTION 23 31 01**HVAC DUCTS AND CASING-LOW PRESSURE****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.
- B. The provisions of Section 23 05 00, Common Work Results for HVAC apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes: Low pressure ductwork and fittings.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Work performed by qualified, experienced mechanics, in accordance with the manual of Duct and Sheet Metal Construction of the Sheet Metal and Air Conditioning Contractors National Association and these Specifications.
- B. Regulatory Requirements:
 - 1. Entire ductwork system, including materials and installation, installed in accordance with NFPA 90A.
 - 2. Ductwork and components shall be listed as U.L. 181, Class I air duct, flame rating not to exceed 25 and smoke rating not to exceed 50.

1.4 SUBMITTALS

- A. Submit the following:
 - 1. Provide catalog data on each product specified hereunder.
 - 2. Schedule of duct construction standards.
 - 3. Provide shop drawings showing materials and construction details for single wall housing plenum.
 - 4. Provide shop drawings showing construction details, support and seismic restraint of ductwork distribution systems.

PART 2 - PRODUCTS**2.1 SUPPORTS, ANCHORAGE AND RESTRAINTS**

- A. General:
 - 1. When supports, anchorages, and seismic restraints for equipment, and supports and seismic restraints for ductwork are not shown on the Drawings, the contractor shall be responsible for their design.
 - 2. Seismic restraints and anchorages shall resist seismic forces as specified in the latest edition of the International Building Code for the seismic zone in which the project is constructed.

3. Seismic restraints shall follow the provisions described in Section 23 05 48, Vibration and Seismic Control for HVAC Piping and Equipment.
 4. Seismic restraints shall not introduce stresses in the ductwork caused by thermal expansion or contraction.
 5. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Suspended Ductwork: Seismic restraints shall be in accordance with the latest edition of the SMACNA "Seismic Restraint Manual - Guidelines for Mechanical Systems" for the seismic hazard level corresponding to the seismic zone in which the project is constructed.
- C. Engineered Support Systems: The following support systems shall be designed, detailed, and bear the seal of a professional engineer registered in the State having jurisdiction:
1. Supports and seismic restraints for suspended ductwork and equipment.
 2. Support frames for ductwork and equipment which provide support from below.
 3. Equipment and ductwork support frame anchorage to supporting slab or structure.

2.2 SHEETMETAL DUCTWORK

- A. Fabricate from galvanized steel, unless noted otherwise.
- B. Minimum gauge, duct construction, joint reinforcing, fittings, hangers and supports shall be in accordance with SMACNA "HVAC Duct Construction Standards", Third Edition, 2005.
- C. Duct Classification: Ducts shall be considered low pressure when design velocities are 2000 fpm or less and maximum static pressure is 2 inches W.G. positive or negative.
1. The following ductwork constructed in accordance with minimum reinforcement requirements for static pressure class of 1/2-inch W.G. positive or negative.
 - a. Supply ductwork downstream from terminal units.
 - b. Supply, return or exhaust ductwork serving fans scheduled to operate at less than 1/2-inch W.G.
 - c. Supply, return, or exhaust branch ductwork which serves one or two inlets/outlets.
 2. The following ductwork constructed in accordance with minimum reinforcement requirements for static pressure class of 1-inch W.G. positive or negative.
 - a. Supply, return, or exhaust ductwork serving fans scheduled to operate at less than 1 inch W.G. On supply fans pressure drops for louvers, coils, clean filters, and sound traps may be deleted from scheduled fan static.
 - b. Supply, return, or exhaust ductwork serving multiple duct branches where contractor can demonstrate that pressures will not exceed 1 inch W.G. positive or negative.
 3. The following ductwork constructed in accordance with minimum reinforcement requirements for static pressure class of 2 inches W.G., positive or negative.
 - a. Supply, return, or exhaust ductwork serving fans scheduled to operate at pressures greater than 1 inch W.G. positive or negative.
- D. Longitudinal seams on rectangular duct shall be Pittsburgh or Button punch snap lock. Snap lock seams for round duct may be used only on ducts classified for 1/2 inch W.G. Longitudinal seams for round ducts using lap and rivet, spot weld, or fillet weld may be used only on ducts classified for statics 1 inch W.G. or less.
- E. Joining and reinforcing systems manufactured by Ductmate, Roloc, or TDC are acceptable. Ductmate 35 is equivalent to SMACNA "J", and Ductmate 25 is equivalent to SMACNA "F".
- F. Use of adjustable round elbows not permitted.

2.3 FLEXIBLE DUCTS

- A. Acceptable Manufacturers:
 - 1. Thermaflex M-KE, Gen Flex IMP-25S.
 - 2. Other Manufacturers: Submit Substitution Request.
- B. Description: Flexible air duct with CPE or metal film liner permanently bonded to coated spring steel wire helix with 1-inch thick fiberglass insulation blanket covered with fiberglass reinforced metal film vapor barrier jacket. Duct rated for 6-inch W.G. positive and 1-inch W.G. negative.

2.4 EXPOSED OR VISIBLE DUCTWORK IN FINISHED SPACES

- A. Round:
 - 1. Material: Round or flat oval, machine formed, spiral lock-seam galvanized sheet metal ductwork of thicknesses as listed for sheet metal duct. Paintable surface.
 - 2. Fittings: Machine formed, shop fabricated, with welded seams, designed for easiest air flow, similar to United Sheetmetal numbers listed.
 - a. Mitered Elbow with Turning Vanes: Type EV-90-2.
 - b. Radius Elbows: Type E090-5. Similar for less than 90 degree elbows.
 - c. Tees: Type Con-T-1.
 - d. Reducing Fittings: May be used unless noted otherwise.
- B. Rectangular: Same as for sheet metal ductwork but paintable surface. All reinforcing shall be inside. Use special care to prevent imperfections in the metal surface.

PART 3 - EXECUTION**3.1 APPLIED LOCATIONS**

- A. Supply ductwork on downstream side of terminal box. Galvanized sheet metal ductwork, lined where indicated on the Drawings or as specified in Section 23 07 00.
- B. Supply Ductwork from Spin-In Fittings to Supply Outlet Collar Connection: Flexible duct, maximum 4'-0" length.
- C. Return Air Trunk Ductwork from End Run to Unit Connection: Galvanized sheet metal ductwork, lined where indicated on the Drawings or as specified in Section 23 07 00.
- D. Exhaust Ductwork: Galvanized sheet metal ductwork, lined where indicated on the Drawings or as specified in Section 23 07 00.
- E. Ductwork between Transfer Grilles: Galvanized sheet metal ductwork, lined where indicated on the Drawings or as specified in Section 23 07 00.
- F. Exposed or Visible Ductwork in Finished Spaces: Sheet metal as specified for application, lined where indicated on the Drawings or as specified in Section 23 07 00.

3.2 INSTALLATION

- A. Ductwork:
 - 1. Seal traverse joints with an approved mastic during joining procedure or tape after joining to provide airtight duct system.
 - 2. Low pressure ductwork hanger and support systems in accordance with SMACNA "HVAC Duct Construction Standards". Wire supports are not allowed.

3. Provide supplementary steel for support of ductwork in shafts and between building structural members.
 4. Fabricate changes in direction to permit easy air flow, using full 1.5D radius bends or fixed turning vanes in square elbows. Radius elbows less than 1.5D radius shall have splitter vanes.
 5. Change in duct size or shape necessitated by interference made using rectangular equivalents of equal velocity.
 6. Where pipe, structural member, or other obstruction passes through a duct, provide streamlined sheet metal collar around member and increase duct size to maintain net free area. Fit collar and caulk to make air tight.
- B. Sound Attenuation (Internal Insulation):
1. Provide sound attenuation duct where shown and as specified under Section 23 07 00.
 2. Duct dimensions shown are net inside attenuating material.
- C. Dampers: Install where shown and where necessary to complete final balancing of system. Install regulators as specified in Section 23 33 00 for each specific project condition. Leave all dampers locked wide open in preparation for balancing.
- D. Extractors: Install behind supply grilles and registers where shown.
- E. Flexible Connectors: Make connections to fans and other rotating equipment with flexible connectors with 2-inch minimum clearance between casing and ductwork. Not required on internally spring isolated units.
- F. Spin-in Fittings:
1. Install at branch takeoffs to outlets using round or flex duct.
 2. Connect to flexible duct with draw band strap and minimum of two wraps of duct tape.
 3. Leave all dampers locked wide open.
- G. Flexible Ducts:
1. Make connections at ends using draw band strap and a minimum of 2 wraps of duct tape.
 2. Suspend center spans from structure above using wire as required by code. Connect to manufacturer's eyelet on jacket or use 1-inch wide galvanized steel strap with single loop at top and smooth edges.
 3. Suspending duct by laying it on the ceiling is prohibited.
 4. Avoid crimping flex duct. All changes in direction shall be made using 2D radius. Duct connections to grilles, registers and diffusers using less than 2D radius bends are not acceptable. Where space is constricted, use sheet metal elbows or Thermaflex Flex Boots (or equal).
- H. Ductwork, Exposed or Visible in Finished Areas:
1. Use extreme care in handling and installing.
 2. Replace all dented or damaged sections.
 3. Install ductwork straight and true, parallel to building lines.
 4. Make all connections with pop rivets using couplings where applicable. Grind all raw edges smooth and apply paintable sealant to cover imperfections.
 5. Remove all excess sealant to provide a finished joint.
 6. Provide floor, wall, and ceiling plates as specified in Section 23 05 00.
 7. Finish, clean and prime all ductwork and hangers for painting.
- I. Fiberglass Ductwork:
1. Install fiberglass ductwork in accordance with manufacturer's installation instructions and NAIMA/SMACNA Fibrous Glass Duct Construction Standards, latest edition.
 2. Use only heat activated tapes specifically approved for use with fibrous glass ductwork and approved by SMACNA.

3. Fibrous glass duct shall be stored in enclosed space and shall not be exposed to weather or water.
4. Prepare duct surfaces prior to taping so that they are free of dust, dirt, oil, grease, fingerprints, moisture, or similar substance which may interfere with proper adhesion and bonding.

3.3 FIELD QUALITY CONTROL

- A. Coordination with Balance Agency:
 1. Provide services of a sheet metal person familiar with the system ductwork to provide assistance to the balancing agency during the initial phases of air balancing in locating all sheet metal dampers.
 2. Install missing dampers required to complete final balancing.

END OF SECTION

SECTION 23 33 00**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 1 Specification Sections, apply to this Section.
- B. The provisions of Section 23 05 00, Common Work Results for HVAC apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes: Medium and low pressure duct accessories, sealants and tapes, flexible connectors, fire dampers, smoke dampers, combination smoke and fire dampers, access doors, automatic dampers, back draft dampers, and mixing boxes.

1.3 QUALITY ASSURANCE

- A. Work performed by qualified, experienced mechanics in accordance with the manual of Duct and Sheet Metal Construction of the National Association of Sheet Metal and Air Conditioning Contractors and these Specifications.
- B. Install entire ductwork system, including materials and installation, in accordance with NFPA 90A.
- C. Flexible connectors, flexible equipment connections, tapes and sealants listed as UL 181, Class I air duct. Flame spread rating not to exceed 25 and smoke developed rating not to exceed 50.

1.4 SUBMITTALS

- A. Submit the following: Product data for Duct Accessories.
 - 1. Low Pressure Duct Accessories:
 - a. Access Doors
 - b. Backdraft Dampers
 - c. Automatic Dampers
 - d. Duct Sealer
 - e. Mixing box and controls
 - 2. Fire and Smoke Dampers:
 - a. Fire Dampers
 - b. Smoke Damper
 - c. Combination Smoke and Fire Dampers
- B. Operation and Maintenance Data: Automatic dampers, fire dampers, smoke dampers. Combination smoke and fire dampers.

PART 2 - PRODUCTS**2.1 LOW PRESSURE DUCT ACCESSORIES**

- A. Acceptable Manufacturers:
1. As indicated.
 2. Other Manufacturers: Submit Substitution Request.
- B. Volume Damper Fabrication:
1. Single blade dampers reinforced or crimped for rigidity, with pivot rod extending through duct. Dampers over 12 inches high use multiple opposed blade damper. Single blade damper no larger than 12 inches x 48 inches. Multiple blade damper factory fabricated, Ruskin MD-35 or equal.
 2. Minimum gauge and duct construction in accordance with SMACNA "HVAC Duct Construction Standards", latest edition.
 3. Splitter and butterfly dampers fabricated of 18 gauge galvanized steel.
 4. Dampers of length suitable to close branch ducts without damper flutter.
 5. Damper blade must be aligned with handle and index pointer.
- C. Flexible Equipment Connections: 30 oz. Ventfabrics Ventglas or Duro Dyne neoprene coated fire retardant glass fabric or approved equal.
- D. Duct Sealer:
1. Based On: McGill Airseal Zero.
 2. Description: Suitable for indoor/outdoor use, rated to 10-inch WG, Maximum Flame Spread/Smoke Developed Rating of 25/50, maximum VOC of 30 g/L less water. SCAQMD Rule 1158 compliant.
- E. Duct Tape for Sheet Metal: ARNO C520 duct tape similar United, Duro Dyne, Nashua, Polymer Adhesive.
- F. Tape and Adhesive/Activator System for Sheet Metal: Hardcast, Polymer Adhesive.
- G. Turning Vane Assemblies:
1. Sheet Metal Vanes: Multiple radius hollow vane air foil type 2-inch (small vane) or 4-1/2-inch (large vane) inside radius, galvanized steel construction.
 2. Runners: Push-on type.
 3. Acoustical Vanes: Multiple radius air foil type, perforated steel construction with fiberglass fill. AirSan Acoustiturn or as approved.
- H. Access Doors:
1. Manufacturer: Air Balance, Ruskin, Metco, Durodyne, Cesco, Nailor-Hart or approved equal.
 2. Doors complete with steel frame, steel door with backing plate, cam latches (two on units 14-inch x 14-inch and larger), hinge and gasketing. Doors on insulated or lined ducts shall be insulated.
 3. Size:
- | Duct Width or Duct Diameter | Net Access Door Opening |
|-----------------------------|-------------------------|
| Up to 8" | 6" x 6" |
| 9" to 12" | 8" x 8" |
| 13" to 20" | 12" x 12" |
| 21" to 30" | 16" x 14" |
| 31" to 42" | 18" x 14" |
| Over 42" | Two 16" x 14" |
- I. Backdraft Dampers:
1. Manufacturer: Air Balance, Ruskin, Cesco, Advanced Air, Nailor-Hart or approved equal.
 2. Description: Gravity operated, vinyl edged, metal bladed backdraft dampers.

2.2 FIRE AND SMOKE DAMPERS

- A. Acceptable Manufacturers: Where Ruskin is the only manufacturer indicated, equivalent products may be furnished.
- B. Static Fire Dampers:
1. Code Compliance: Provide static fire dampers with a U.L. 555 label for fire rating indicated and in conformance with NFPA 90A.
 2. Dampers shall be integrally hinged, folding blade curtain type, for installation in ductwork complete with 160°F fire link and retainer.
 3. Dampers shall be suitable for horizontal or vertical installation as required. Furnish stainless steel closure springs and cam lock for complete damper closure on dampers to be installed in vertical air flow positions.
 4. Medium pressure, 1-1/2-hour: For use in partitions up to 2-hour rating with damper out of air stream. Ruskin Model IBD2, Style C for rectangular, Style CR for round, style CO for oval.
 5. Medium pressure, 3-hour: for use in partitions over 2-hour rating with damper out of air stream. Ruskin Model IBD23, Style C for rectangular, Style CR for round, Style CO for oval.
 6. Low pressure, 1-1/2-hour: For use in partitions up to 2-hour rating with damper out of air stream for supply.
 - a. Ruskin Model IBD2 Style B for supply.
 - b. Ruskin Model IBD2 Style A for return or exhaust.
 7. Low pressure, 3-hour: for use in partitions over 2-hour rating with damper out of air stream for supply.
 - a. Ruskin Model IBD23 Style B for supply.
 - b. Ruskin Model IBD23 Style A for return or exhaust.
 8. Transfer grilles, 1-1/2-hour: 7/8-inch deep for use in partitions up to 2-hour rating. Ruskin Model IBDT "Thinline".
 9. Ceiling fire dampers with 20 gauge galvanized steel blades, 212°F fusible link, U.L. listed, Ruskin CFD (R) 2 or CFD (2) 3. Provide thermal blanket.
- C. Smoke Damper: Fabricate from 16 gauge channel and blades, UL555S leakage Class II, conforms to NFPA 90A smoke damper requirements, internal 120V electric operator, maximum blade length 36-inches x 6-inches. Ruskin SD36.
- D. Combination Fire and Smoke Dampers:
1. Multiblade damper with linkage, extended control rod and damper operator with UL Fire Damper Label. Provide round or oval duct connections where required. Operator to be factory-installed, electric type, 120V with spring return to closed position. Stall type motors are not acceptable.
 2. Medium pressure, 1-1/2 hour: for use in partitions up to 2-hour rating. Airfoil shape blades, Ruskin Models FSD60 or FSDR25.
 3. Medium pressure, 3 hour: for use in partitions over 2-hour rating. Airfoil shape blades, Ruskin Model FSD60-3
 4. Low pressure, 1-1/2 hour: for use in partitions up to 2-hour rating. Ruskin Model FSD36.
 5. Low pressure, 3-hour: for use in partitions over 2-hour rating. Ruskin Model FSD60-3.
 6. Provide factory installed and wired U.L. Listed duct smoke detector for 0-3000 fpm flow, Ruskin Model DSDN as part of assembly. Provide contactor from smoke detector to fire alarm system.

2.3 MIXING BOX

- A. Acceptable Manufacturers: MicroMetl, or equal.

- B. Description: Mixing box – Galvanized sheet metal, Honeywell W7212 controller, adjustable dry bulb sensor, Belimo actuator, internally insulated.
- C. Controls: Includes Honeywell W7212 controller, supply mixed air temperature sensor, OA sensor, and spring return actuator, Belimo.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all devices as shown on the Contract Drawings and per manufacturer's recommendations.
- B. Low Pressure Duct Accessory installation specified under Section 23 33 01.
- C. Fire Dampers:
 - 1. Install dampers in accordance with NFPA 90A and manufacturer's written recommendations.
 - 2. Size and locate dampers as shown on Drawings.
 - 3. Install dynamic fire dampers in correct position with regards to direction of air.
 - 4. Where dampers are not accessible for servicing by removing an outlet, provide access doors for servicing. Doors shall be compatible with the duct in which they are installed.
- D. Smoke Dampers and Combination Fire and Smoke Dampers:
 - 1. Install dampers in accordance with NFPA 90A and manufacturer's written recommendations.
 - 2. Size and locate dampers as shown on Drawings.
 - 3. Where dampers are not accessible for servicing by removing an outlet, provide access doors for servicing. Doors shall be compatible with the duct in which they are installed.
- E. Access Doors: Install where indicated and at all duct mounted coils, humidifiers, automatic control dampers, smoke dampers, fire dampers, air flow stations, to provide access for cleaning and maintenance.
- F. Back Draft Dampers: Install where indicated and at the discharge (or inlet) of exhaust fans where automatic dampers are not indicated.

END OF SECTION

SECTION 23 37 00**AIR OUTLETS AND INLETS****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.
- B. The provisions of Section 23 05 00, Common Work Results for HVAC apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes: Ceiling diffusers, sidewall grilles.
- B. Related Sections include:
 - 1. Section 23 33 00 Duct Accessories.

1.3 SUBMITTALS

- A. Submit the following:
 - 1. Shop Drawings: Showing dimensions and details of construction.
 - 2. Product Data.

PART 2 - PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. Manufacturers: Price, Titus, or equal
- B. All such products shall be of one manufacturer.
- C. Other Manufacturers: Submit substitution Request.

2.2 PERFORMANCE

- A. Unit sizing is based on air being introduced at 20°F temperature differential and being diffused at the 5-foot level to a velocity not greater than 50 FPM and a temperature differential not greater than 1.5°F. Units are also selected so as not to exceed the NC-30 curve.

2.3 DIFFUSERS AND GRILLES

- A. Refer to equipment schedule for make and model.
- B. Finish selected by architect.
- C. Ceiling Supply Diffuser: Perforated face modular diffuser with adjustable modular core, steel panel, square or rectangular neck size as indicated, discharge pattern as indicated, lay-in tee bar ceiling, or surface mounted as required (coordinate with architectural reflected ceiling plan).

- D. Ceiling Return/Exhaust Grille: Perforated face modular ceiling grille, steel panel, with duct adapters for round or rectangular as indicated, lay-in tee bar ceiling, or surface mounted as required (coordinate with architectural reflected ceiling plan).
- E. Slot Return: Extruded Aluminum ceiling slot diffuser, length as indicated. Frame and border to match ceilings as indicated. Finish as selected by architect.
- F. Slot Diffuser: Extruded aluminum ceiling slot diffuser, pivoting paddle pattern controllers, length as indicated on drawings and architectural reflective ceiling plans. Provide insulated plenum boots, 1/2-inch fiberglass insulation designed by diffuser manufacturer specifically for field attachment to diffuser. Ceiling application as shown.
- G. Floor Supply Grille: Extruded aluminum, bars fixed and parallel to long dimension, removable core with core clips.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all diffusers tight to their respective mounting surfaces.
- B. Installed plumb and true with room dimensions and accurately centered on projections as shown on the Architectural reflected ceiling plans.
- C. Install extractors behind all duct mounted sidewall supply grilles, and where shown. Turning vanes allowable if condition is the last outlet on a branch.
- D. Set pattern control for directions of throw as shown on Drawings prior to air balancer arriving on Project.
- E. Paint ductwork behind all outlets flat black.

END OF SECTION

SECTION 23 81 00 - DECENTRALIZED UNITARY HVAC EQUIPMENT

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.
- B. The provisions of Section 23 05 00, Common Work Results for HVAC apply to work specified in this Section.

1.2 SUMMARY

- A. This Section includes:
 - 1. Rooftop mounted packaged air conditioning units and heat pumps.
 - 2. Ceiling mounted packaged air conditioning units and heat pumps.
 - 3. Floor mounted packaged air conditioning units and heat pumps.
 - 4. Packaged thru wall air conditioning units and heat pumps.
 - 5. Condensing unit.
 - 6. Fan coil unit.
 - 7. Wall mounted split system air conditioning units.
 - 8. Variable Refrigerant Flow System.
- B. Related Sections include:
 - 1. Section 23 05 14 Variable Frequency Drives for HVAC Equipment.
 - 2. Section 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment.
 - 3. Section 23 82 00 Convection and Heating and Cooling Units.
 - 4. Section 23 09 00 Instrumentation and Controls for HVAC.
 - 5. Section 23 09 93 Sequence of Operations for HVAC Controls.

1.3 SUBMITTALS

- A. Submit the following:
 - 1. Shop drawings showing details of construction, dimensions, arrangement of components, isolation, filters, etc.
 - 2. Product data showing performance data, standard items and accessories, operating weight.
 - 3. Operating and maintenance data.

PART 2 - PRODUCTS

2.1 AIR COOLED CONDENSING UNIT

- A. Acceptable Manufacturers:
 - 1. Daikin, LG, Samsung
 - 2. Other Manufacturers: Submit Substitution Request.

- B. Description: Provide air cooled condensing units designed for outdoor installation with factory supplied supports, properly assembled and tested at the factory. Unit shall be completely weatherproofed and include compressor, condenser coils, condensing fans, motor, refrigerant reservoir, charging valve, all controls, and a holding charge of R32. Provide guards on condenser fans and coil guard.
- C. Compressors: Furnish hermetically sealed type with isolation and sound muffling. Units shall have overload and inherent winding thermostat protection to prevent burn out. Provided crankcase heater. Multiple compressors shall be manifolded for single joint connection on liquid and suction lines.
- D. Refrigeration Circuits: Unit shall include back seating service valve and gauge ports in liquid and suction lines. Provided refrigerant filter-dryer.
- E. Condenser Coil: Non-ferrous construction consisting of aluminum plate fins mechanically bonded to seamless copper tubes and circuited for sub-cooling.
- F. Condenser Fans and Motors: Direct driven propeller type fans with permanently lubricated motors.
- G. Sizing: Select units for actual refrigerating capacities at coil including line losses. See schedule on drawings.
- H. Controls: Complete, factory-installed control system with all operating and safety controls. Provide high and low pressure cutouts, contractors and internal overload protection on all motors. Provide low ambient operation to [50°F] [0°F] outside to maintain condensing temperature on part load operation. Provide short cycle timer. Include all remote sensors and devices for field installation.
 - 1. Refer to Section 23 09 93 Sequence of Operations for HVAC Controls for required controls, control functions and sequences of operation for the factory-installed controls.
- I. Controls Interface: The packaged equipment controls shall be equipped with a network port and shall have a network type data transfer interface with the DDC controller. The following interface shall be required:
 - 1. BACnet protocol compatible with the system specified in Section 23 09 00.
 - 2. All alarms shall be read to the DDC controller.
 - 3. The following status signals shall be read to the DDC controller as a minimum: Compressors, condensers.
- J. Supports: Provide structural steel support, submit for review before fabrication.

2.2 FAN COIL UNIT

- A. Acceptable Manufacturers:
 - 1. Daikin, LG, Samsung
 - 2. Other Manufacturers: Submit Substitution Request.
- B. Description: Furnish complete unit including cabinet, fan and motor assembly, electric heating, cooling coil and filter. Unit U.L. approved for application and wired per NEC.
- C. Cabinet: 18 gauge steel, removable panels for access to components.
- D. Fan and Motor: Centrifugal type, belt driven, permanently lubricated motor.
- E. Filters: Throwaway type, 1-inch thick fiberglass.

- F. Heating/Cooling Coil: Non-ferrous construction with aluminum fins mechanically bonded to seamless copper tubing with all joints brazed.
- G. Drain Pan: Galvanized steel drain pan with copper drain connection. Pan to extend under coil for proper drainage of condensate.
- H. Configuration: Horizontal unit, ducted inlet and outlet connection.
- I. Controls: Configure unit for field installation of DDC control panel and sensors as follows:
 - 1. Valves, actuators and space temperature sensor will be furnished under Section 23 09 00 for field installation.
 - 2. Refer to Section 23 09 93 for additional information on required controls, control functions and sequences of operation for both field and factory-installed controls.
- J. Electrical: Furnish magnetic contactors. Arrange for single point electrical connection. Provide all field wiring.

2.3 VARIABLE REFRIGERANT FLOW SYSTEM

- A. Acceptable Manufacturers:
 - 1. Daikin, LG, Samsung
- B. Indoor Unit – Floor Standing Concealed or Exposed:
 - 1. Description: The unit shall consist of a floor-standing indoor section. Furnish complete unit including cabinet, mounting kit and accessories, refrigerant line set, electronic expansion valve, fan and motor assembly, cooling coil, condensate drain pan and filter. Unit as scheduled on drawing, factory-tested and assembled, factory wired, refrigerant-to-air heat exchanger, fan/motor assembly, compressor, controls and safety devices, control circuit transformer, shipped in one piece with ARI certification and UL listing.
 - 2. Cabinet: 18 gauge steel, removable panels for access to components. Provide drain connection. Exposed units shall have painted finish. Concealed units shall have sheet metal finish.
 - 3. Fan and Motor: The evaporator fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The fan shall consist of two (2) speeds, High and Low.
 - 4. Coil/Piping: The indoor coil shall be direct expansion type of nonferrous construction with smooth plate fins on copper tubing. A condensate pan shall be located under the coil. Both refrigerant lines shall be insulated.
 - 5. Filter: Return air shall be filtered by means of an easily removable, washable filter.
 - 6. Electrical: Furnish all starters, contactors and disconnects. Arrange for single point electrical connection.
 - 7. Condensate pump: Provide condensate pump when required; pipe drain to floor drain.
- C. Indoor Unit – Controls:
 - 1. Controls: Unit shall have a wired controller to perform input functions necessary to operate the system. The controller shall consist of an On-Off switch, Thermostat setting, Timer Mode, High-Low fan speed, Auto Vane selector, Test Run switching and Check Mode switching. The system shall be capable of automatic restart when power is restored after power interruption. The microprocessor within the wall mounted remote controller shall provide automatic cooling, display set point and room temperature, 24 hour on/off timer so that automatic operation function display, check mode for memory of most recent problem. Verify if optimal start for energy code.
- D. Outdoor Unit:

1. Description:
 - a. Provide air cooled air conditioner (outdoor unit) designed for outdoor installation with factory supplied supports, properly assembled and tested at the factory.
 - b. Unit shall be completely weatherproofed and include compressor, condenser coils, condensing fans, motor, refrigerant reservoir, charging valve, all controls and a holding charge of refrigerant.
 - c. Provide guards on condenser fans and coil guard. Unit shall have a power coated finish.
 - d. Unit shall be completely factory assembled, piped, wired and tested.
 - e. Both refrigerant lines shall be insulated between the outside and inside units.
 - f. Unit shall have a sound rating no higher than 63 dB(A).
 - g. The units shall be modular in design and allow for side-by-side installation with minimum spacing.
 2. Cabinet: The casing(s) shall be fabricated of galvanized steel, bonderized and finished with baked enamel.
 3. Condenser Fans and Motors: Direct driven variable speed propeller type fans with permanently lubricated motors. All fans shall be provided with a raised guard to prevent contact with moving parts. The outdoor unit shall have vertical discharge airflow.
 4. Refrigerant Circuits: Units shall hold a charge of R32 refrigerant. Unit shall include back seating service valve and gauge ports in liquid and suction lines. Provided refrigerant filter-dryer. The refrigeration circuit of the condensing unit shall consist of a scroll compressor, motors, fans, condenser coil, electric expansion valve, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut-off valves, oil separators, service ports, liquid receivers and accumulators.
 5. Coil: The outdoor coil shall be of nonferrous construction with lanced or corrugated plat fins on copper tubing.
 6. Compressors: Furnish inverter driven scroll hermetic sealed compressor isolation and sound muffling. Units shall have overload and inherent winding thermostat protection to prevent burn out. Provided crankcase heater. Multiple compressors shall be manifolded for single joint connection on liquid and suction lines. The capacity shall be completely variable down to 16% of rated capacity.
 7. Controls: Provide high and low pressure cutouts, contractors and internal overload protection on all motors. Provide low ambient operation to 0°F outside to maintain condensing temperature on part load operation. Provide short cycle timer.
- E. Controls Interface: The control system shall be equipped with a network port and shall have a network type data transfer interface with the DDC controller. The following interface shall be required:
1. BACnet protocol compatible with the system specified in Section 23 09 00.
 2. All alarms shall be read to the DDC controller.
 3. The following analog signals shall be read to the DDC controller as a minimum: Space temperature.
 4. The following status signals shall be read to the DDC controller as a minimum: Occupied Cycle, Unoccupied Cycle, Warmup, Override, Supply Fan, Compressors, Heating/Cooling Operation.

PART 3 - EXECUTION

3.1 VARIABLE REFRIGERANT FLOW SYSTEM

- A. Installation:
1. Install in location shown on the Drawings. Level unit and secure to structure.
 2. Make piping connections and unit installation per manufacturer's recommendations and installation guides.

3. Size and run refrigerant piping between fan coil unit and air-cooled condensing unit per manufacturer's recommendations. Provide double suction and/or discharge risers if recommended by the manufacturer.
 4. Insulate all refrigerant piping.
 5. Pipe condensate pan to floor drain per manufacturers installation guide.
- B. Start-up:
1. General: Comply with manufacturer's instructions.
 2. Install filters before operating unit.
 3. Ensure proper refrigerant and air flow before operating unit compressor.
- C. Provide interconnecting power and control wiring.
- D. Testing and Adjusting/Performance Test: Except where initial unit operation clearly shows the performance meets or exceeds the requirements, test to show compliance. The manufacturer's representative in the presence of the Engineer shall perform tests.

END OF SECTION

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SECTION 260505

SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as indicated.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Report discrepancies to Architect before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
 - 1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
 - 2. PCB- and DEHP-containing lighting ballasts.
 - 3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

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- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- H. Repair adjacent construction and finishes damaged during demolition and extension work.
- I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

- A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.
- C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

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SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.
- D. Electrical tape.
- E. Wire pulling lubricant.
- F. Cable ties.
- G. Firestop sleeves.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- G. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.
- H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
- I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Most Recent Edition, Including All Revisions.
- N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

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Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

R. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 260526.
- H. Conductor Material:
 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 3. Tinned Copper Conductors: Comply with ASTM B33.
- I. Minimum Conductor Size:
 1. Branch Circuits: 12 AWG.
 - a. Exceptions:

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- 1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.
- J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- K. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 2. Color Coding Method: Integrally colored insulation.
 3. Color Code:
 - a. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - b. Equipment Ground, All Systems: Green.
 - c. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. Encore Wire Corporation: www.encorewire.com/#sle.
 - c. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
 - d. Service Wire Co: www.servicewire.com/#sle.
 - e. Southwire Company: www.southwire.com/#sle.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. Installed Underground: Type XHHW-2.
 - c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.04 METAL-CLAD CABLE

- A. Manufacturers:
1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 2. Southwire Company: www.southwire.com/#sle.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
 2. Size 8 AWG and Larger: Stranded.

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- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Grounding: Full-size integral equipment grounding conductor.
- G. Armor: Steel, interlocked tape.

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- C. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 - 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 - 6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
- D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- E. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- F. Mechanical Connectors: Provide bolted type or set-screw type.
- G. Compression Connectors: Provide circumferential type or hex type crimp configuration.
- H. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.06 ACCESSORIES

- A. Electrical Tape:
 - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 - 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 - 3. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).
- B. Wire Pulling Lubricant:
 - 1. Listed and labeled as complying with UL 267.

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2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
3. Suitable for use at installation temperature.
- C. Cable Ties: Material and tensile strength rating suitable for application.
- D. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- E. Fire-Protective Coating for Electrical Conductors and Cables: Field-applied, intumescent or ablative coating designed to prevent ignition and propagation of fire along thermoplastic-insulated conductors and cables.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated without specific routing, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.
 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 - b. Increase size of conductors as required to account for ampacity derating.
 7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:
 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

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4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- H. Terminate cables using suitable fittings.
 1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- I. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- L. Make wiring connections using specified wiring connectors.
 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- N. Insulate ends of spare conductors using vinyl insulating electrical tape.
- O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- P. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

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SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

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- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Bonding and Equipment Grounding:
 - 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 - 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 - 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 - 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 - 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 - 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
- F. Communications Systems Grounding and Bonding:
 - 1. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4 inch (21 mm) trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
 - 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
 - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 - 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
- D. Ground Bars:
 - 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 - 2. Size: As indicated.
 - 3. Holes for Connections: As indicated or as required for connections to be made.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- D. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

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SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- C. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- D. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- E. Section 265600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.
- F. Section 270529 - Hangers and Supports for Communications Systems.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
 - 2. Coordinate work to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
 - 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
 - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 033000.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.

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- B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.06 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. NFPA 70.
 - b. Requirements of authorities having jurisdiction.
 - 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
 - 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
 - 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- D. Metal Channel/Strut Framing Systems:
 - 1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 - 2. Comply with MFMA-4.
- E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
 - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 - 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 - 4. Hollow Masonry: Use toggle bolts.
 - 5. Hollow Stud Walls: Use toggle bolts.
 - 6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
 - 7. Sheet Metal: Use sheet metal screws.
 - 8. Wood: Use wood screws.
 - 9. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Manufacturer: Same as manufacturer of metal channel/strut framing system.

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- b. Comply with MFMA-4.
- c. Channel Material: Use galvanized steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 - 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
 - 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- I. Secure fasteners in accordance with manufacturer's recommended torque settings.
- J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 260533.13

CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Galvanized steel intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Galvanized steel electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 078400 - Firestopping.
- C. Section 260526 - Grounding and Bonding for Electrical Systems.
- D. Section 260529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- E. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- F. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.
- G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- K. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- L. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
- M. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- N. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- P. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- Q. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- R. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

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1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.
 2. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.
 3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
 4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or schedule 80 rigid PVC conduit where emerging from underground.
 5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows, galvanized steel intermediate metal conduit (IMC) elbows, PVC-coated galvanized steel rigid metal conduit (RMC) elbows, or concrete-encased PVC elbows for bends.

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- D. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC) or galvanized steel electrical metallic tubing (EMT).
- E. Concealed Above Accessible Ceilings: Use stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- F. Interior, Damp or Wet Locations: Use galvanized steel intermediate metal conduit (IMC) or galvanized steel electrical metallic tubing (EMT).
- G. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- H. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).
- I. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
 - 1. Maximum Length: 6 feet (1.8 m).
- J. Flexible Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit (FMC).
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
 - 3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Motors.
- K. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC) or galvanized steel electrical metallic tubing (EMT).

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- C. Provide products listed, classified, and labeled as suitable for purpose intended.
- D. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4-inch (21 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4-inch (21 mm) trade size.
 - 3. Flexible Connections to Luminaires: 3/8-inch (12 mm) trade size.
 - 4. Underground, Exterior: 1-inch (27 mm) trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 - 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - c. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

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2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 2. Material: Use steel or malleable iron.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch (1.02 mm).
- C. PVC-Coated Boxes and Fittings:
 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
 3. Material: Use steel or malleable iron.
 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch (1.02 mm).
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch (0.38 mm).

2.06 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.08 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

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3. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.

2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch (0.51 mm).
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).
- E. Foam Conduit Sealant:
 1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
 2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 3. Rated to hold minimum of 10 ft (3.0 m) water head pressure.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Conduit Routing:
 1. When conduit destination is indicated without specific routing, determine exact routing required.
 2. Conceal conduits unless specifically indicated to be exposed.
 3. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
 4. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
 5. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
 - a. Hot water piping.

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b. Flues.

H. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

I. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

J. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.

K. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated; see Section 033000.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

M. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
 - a. Where conduits enter building from outside.
 - b. Where service conduits enter building from underground distribution system.
 - c. Where conduits enter building from underground.
 - d. Where conduits may transport moisture to contact live parts.

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2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
 - a. Where conduits pass from outdoors into conditioned interior spaces.
 - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Provide grounding and bonding; see Section 260526.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

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SECTION 260533.16

BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).
- C. Boxes and enclosures for integrated power, data, and audio/video.
- D. Floor boxes.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 262726 - Wiring Devices:
 - 1. Wall plates.
 - 2. Floor box service fittings.
 - 3. Additional requirements for locating boxes for wiring devices.
- D. Section 271000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

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3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
- C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use suitable concrete type boxes where flush-mounted in concrete.
 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 6. Use shallow boxes where required by the type of wall construction.
 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

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9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 12. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - b. Communications Systems Outlets: Comply with Section 271000.
 13. Wall Plates: Comply with Section 262726.
 14. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
 - c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
 - d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - e. Thomas & Betts Corporation: www.tnb.com/#sle.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.
 3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 4. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.
 - b. Hoffman, a brand of Pentair Technical Products; _____: www.hoffmanonline.com/#sle.
 - c. Hubbell Incorporated; Wiegmann Products; _____: www.hubbell-wiegmann.com/#sle.
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
- E. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
 2. Use sheet-steel or cast iron floor boxes within slab above grade.
 3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
 4. Manufacturer: Same as manufacturer of floor box service fittings.

2.02 ACCESSORIES

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
1. Manufacturers:
 - a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

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PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- F. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
 - 2. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
 - b. Communications Systems Outlets: Comply with Section 271000.
 - 3. Locate boxes so that wall plates do not span different building finishes.
 - 4. Locate boxes so that wall plates do not cross masonry joints.
 - 5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
 - 7. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) horizontal separation.
- G. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
- H. Install boxes plumb and level.
- I. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
 - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
- J. Install boxes as required to preserve insulation integrity.
- K. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

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- M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- N. Close unused box openings.
- O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- P. Provide grounding and bonding in accordance with Section 260526.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

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SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Floor marking tape.
- E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

- A. Section 099113 - Exterior Painting.
- B. Section 099123 - Interior Painting.
- C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- D. Section 260573 - Power System Studies: Arc flash hazard warning labels.
- E. Section 262726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

- A. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Enclosed switches, circuit breakers, and motor controllers:

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- 1) Identify voltage and phase.
- 2) Identify load(s) served. Include location when not within sight of equipment.
2. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
3. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances.
 - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches (76 mm) wide, painted in accordance with Section 099123 and 099113.
4. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations indicated.
5. Arc Flash Hazard Warning Labels: Comply with Section 260573.
- B. Identification for Conductors and Cables:
 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- C. Identification for Devices:
 1. Wiring Device and Wallplate Finishes: Comply with Section 262726.
 2. Use identification label to identify fire alarm system devices.
 3. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
 - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
- B. Identification Labels:
 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
 1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 2. Legend:
 - a. Equipment designation or other approved description.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height:
 - a. Equipment Designation: 1/2 inch (13 mm).
 5. Color:

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a. Normal Power System: White text on black background.

D. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Black text on clear background.

2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch (3 mm).
- F. Color: Black text on white background unless otherwise indicated.

2.04 FLOOR MARKING TAPE

- A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches (76 mm) wide, with alternating black and white stripes.

2.05 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 1. Materials:
 2. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.
- C. Warning Labels:
 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 1. Surface-Mounted Equipment: Enclosure front.
 2. Flush-Mounted Equipment: Inside of equipment door.
 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 4. Elevated Equipment: Legible from the floor or working platform.
 5. Branch Devices: Adjacent to device.
 6. Interior Components: Legible from the point of access.

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- 7. Conductors and Cables: Legible from the point of access.
- 8. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

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SECTION 260943

NETWORK LIGHTING CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Distributed Digital Lighting Control System: System includes
 - 1. Wired and Wireless Digital Lighting and Plug Load Controls
 - 2. 0-10V Relay Panels
 - 3. Emergency Lighting Control.

1.02 RELATED SECTIONS

- A. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
- B. Section 26 51 00 - Interior Lighting Fixtures, Lamps, and Ballasts.
- C. Section 26 52 00 - Emergency Lighting.
- D. Section 25 55 00 - Integrated Automation, building integrator shall provide integration of the lighting control system with Building Automation Systems.

1.03 REFERENCES

- A. FCC emission standards.
- B. NEMA - National Electrical Manufacturers Association.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association.
- D. UL - Underwriters Laboratories, Inc. Listings.
- E. UL 20 - General Use Switches, Plug Load Controls.
- F. UL 924 - Standard for Emergency Lighting and Power Equipment.
- G. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.
- H. ULC - Underwriter Laboratories of Canada Listings.
- I. California Title 24, Part 6 Energy Code
- J. ISO 27001 Information Security Management Systems
- K. ioXt - Internet of Secure Things
- L. OpenADR — OpenADR Alliance

1.04 DESIGN / PERFORMANCE REQUIREMENTS

- A. Distributed Digital Lighting Control System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, dimmers, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
- B. System shall conform to requirements of NFPA 70.
- C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.
- D. System shall be listed under UL sections 916 and/or 508.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 — Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Catalog cut sheets and specifications.
 - 2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

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3. Storage and handling requirements and recommendations.
4. Installation instructions.
5. Network Lighting Controls Certification
- C. Shop Drawings: Wiring diagrams for the various components of the System specified including:
 1. Show location of devices, including at minimum load controllers, sensors, and switches/dimmers on reflected ceiling plans. Identify controlled circuits.
 2. Provide room/area typical wiring and/or installation details including products and sequence of operation for each room or area. Illustrate recommended room/area connection topologies.
 3. Network riser single line diagram including floor and building level details. Include network cable specification. Illustrate connections to any integrated systems. Coordinate integration with mechanical and/or other trades.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Closeout Submittals:
 1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
 2. Operation and Maintenance Manual:
 - a. Include approved Shop Drawings and Product Data.
 - b. Include Sequence of Operation, with operation for each room or space.
 - c. Include manufacturer's maintenance information.
 - d. Operation and Maintenance Data: Include detailed information on device programming and setup.
 - e. Include startup and test reports.
- F. Title 24 Acceptance Testing Documentation: Submit Certification of Acceptance and associated documentation for lighting control acceptance testing performed in accordance with CALIFORNIA TITLE 24, PART 6, as specified in Part 3 of this specification under "COMMISSIONING".

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing of manufacturing centralized and distributed lighting control systems with a minimum of 10 years documented experience.
- B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.
- C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.
- D. Manufacturers should be able to demonstrate that any controls provided that can connect to the internet provide a reasonable level of security based on California's SB-327 requirements. Ensure that devices that allow for communication between the controls system hierarchy and/or the internet are covered by a manufacturer certified via ISO/IEC 27001:2013 which has 114 cyber security related controls. Certify and demonstrate that any controls provided that can connect to the internet provide a reasonable level of security and ensure that that devices that allow for communication between the controls system hierarchy or the internet are certified by ioXt Alliance and listed on the ioXt website's current Certified Product Page (under Ecosystem - Network Lighting Controls).

1.07 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to commencing installation. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.
- B. Review installation procedures and coordination required with related Work and the following:
 1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.

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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 differences between any wired or wireless products on the project.
 5. Discuss requirements for integration with other trades
- C. Inspect and make notes of job conditions prior to installation:
1. Record minutes of the conference and provide copies to all parties present.
 2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
 3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

1.09 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's documented limits.
- B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
 2. Relative humidity: Maximum 90 percent, non-condensing.

1.10 WARRANTY

- A. Product Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement of any devices deemed faulty.

1.11 MAINTENANCE AND OPERATIONAL SERVICES

- A. Remote Access and Enhanced Warranty for Networked Lighting Controls: Provide Manufacturer's Remote Access and Enhanced Warranty for Networked Lighting Controls as follows:
1. Configure to allow the manufacturer remote access to the lighting control system. Configuration includes at a minimum: cellular modem, antenna for the modem, cellular service contract and any components required to enable communication to the specified Network Lighting Control system.
 2. Remote Access program automatically triggers a First Year Enhanced Warranty Agreement starting once lighting control system startup is complete and accepted by the Owner. During this one year period, the Owner's authorized site contact can request the manufacturer to check the system for proper operation and make any programmable changes desired. Manufacturer shall provide a phone number dedicated to customer calls concerning Remote Accessible systems and a support organization capable of enabling cellular communication to the system for troubleshooting and making requested changes to the system. Users requesting remote support on the system shall be fully verified by the Remote Operations Center (ROC) before providing remote support or making any changes to the system. Systems that allow the modem to be always accessible will not be acceptable. Access must be by a secured VPN connection to the private lighting control network that is completely isolated from the Owner's internal network. Remote access that requires a connection through the Owner's internal network is not acceptable.
 3. Owners may continue the Remote Access Program after the first year. However, if the Owner does not continue the enhanced warranty the cellular contract will lapse, and all hardware components, while still remaining property of the manufacturer, will remain in situ so that they can be re-activated at a later time should the Owner desire.

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4. Manufacturer's Remote Access capability shall provide at a minimum the following features:
 - a. Ability to provide initial system diagnostics through LMCS Software to detect fault conditions in wiring or connected devices.
 - b. Access to all devices via LMCS Software to program device functions. This will include scheduling of Time of Day Events and programming of individual device parameters to meet Sequence of Operation requirements.
 - c. Access to the LMJA-8xxx browser-based interface (if included on project) to verify it is setup per project documentation and is completely functional.
 - d. On demand access to manufacturer technical support via a Remote Operations Center (ROC) that will provide remote troubleshooting, diagnostics, and configuration/programming assistance.
 - e. Additional client training and tuning on the Lighting Control System after building occupancy can be performed while remotely connected to the site.
 - f. Site Readiness Check (SRC) which allows the Remote Operations Center to perform a remote discovery of all devices connected to the lighting control network during installation. DLM Networked projects that have a RACCESS cellular modem and have successfully completed the SRC process, defined as 80% or more of the networked devices are found during network discovery, will receive priority scheduling. After scheduled on site startup, all manufacturer provided startup work for a site with a successful SRC will be done remotely, or via complimentary return trips.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Wattstopper/Legrand: Digital Lighting Management (DLM), which is located at: 2240 Campbell Creek Blvd #110; Richardson, TX 75082; Tel: 1-800-879-8585; Email: request info; Web: <https://www.legrand.us/wattstopper.aspx>
- B. Requests for substitutions will be considered in accordance with provisionsthe provisions of Section 01 60 00 - Product Requirements.

2.02 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

- A. System General: Provide a Wattstopper Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified between the Drawing and this Specification contact the Architect for clarification prior to proceeding.
 1. Default to project's determined Energy Code requirements and specifier's Sequence of Operation (SoO); otherwise follow below narrative:
 2. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except where hands-free operation is desirable and Automatic-ON occupancy sensors are allowed. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling, corner, or fixture mounted sensors, and set up for Manual-ON or Partial-On operation.
 3. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
 - a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
 - b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
 - c. Multi-zone sensors may be utilized for daylight areas on the drawings.

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- d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels.
- B. Local Room Communication Network: DLM communications in room can either be over a wireless IPv6 network, a wired Cat 5e network referred to as local network or In Room Bus (IRB), or a hybrid with wired Room Controllers, a wireless bridge, and additional wired and/or wireless accessory devices.
 1. Wired Room Network with LMRJ Cat 5e cables: DLM local or In Room Bus (IRB) network is a free topology lighting control physical connection and communication protocol designed to control a room or small area of building.
 - a. Features of the wired DLM local network include:
 - 1) Plug n Go automatic configuration and binding of occupancy sensors, switches, and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
 - 2) Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration, or setup.
 - 3) Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
 - 4) Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
 - b. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide digital communication from individual end devices are not acceptable.
 - c. If manufacturer's pre-terminated Cat5e cables are not used for the installation, each contractor terminated cable must be individually tested and logged provided to any authorized service representative following installation.
 2. Hybrid Room Network: Local room network is formed using a combination of wired room controllers, a wireless bridge, and wired and/or wireless accessory occupancy sensors and switches/dimmers/devices.
 - a. Features of the Hybrid DLM local network include:
 - 1) A wireless network bridge is included in the room to act as a bridge between devices that use a wired local IRB network and the devices that use a wireless local IRB PAN network.
 - 2) Wireless room devices utilize a trusted hardware chip to ensure that only the manufacturer's products can access and participate in the wireless network.
 - 3) Wireless bridge shall be capable of communicating with other wireless bridges, wired load controllers in the room, and a Secondary border router to enable a large-scale low power self-healing IPv6 mesh communication network between rooms in the area PAN.

2.03 WIRED DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD AND FIXTURE)

- A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers or require special configuration for standard Plug n' Go applications. Control units include the following features:
 1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room (Plug n Go(tm))
 2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.

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3. Multiple wired load controllers connected in a local wired IRB network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device serial number from highest to lowest.
4. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
5. Quick installation features including:
 - a. Standard junction box mounting
 - b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
 - a. Turn on to 100 percent
 - b. Turn off
 - c. Turn on to last level
7. Each load be configurable to operate in the following sequences based on occupancy:
 - a. Auto-on/Auto-off (Follow on and off)
 - b. Manual-on/Auto-off (Follow off only)
8. Polarity of each load output shall be reversible, via digital configuration, so that an on command turns load off and an off command turns a load on.
9. BACnet object information shall be available for the following objects:
 - a. Load status
 - b. Schedule state, normal or after-hours
 - c. Demand Response enable/ and disable
 - d. Room occupancy status
 - e. Total room lighting and plug loads watts
 - f. Electrical current
 - g. Total watts per controller
 - h. Total room watts/sqft.
10. UL 2043 plenum rated
11. LED On/Off status indication for each load
12. Zero cross circuitry for each load
13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
14. Dimming Room Controllers shall share the following features:
 - a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours to allow different dimmed levels to be established.
 - b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
 - c. The following dimming attributes may be changed or selected using a wireless configuration tool:
 - 1) Establish preset level for each load from 0-100 percent
 - 2) Set high and low trim for each load
 - 3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
 - d. Override button for each load provides the following functions:
 - 1) Tap for on/off control
 - 2) Press and hold for dimming control (lighting only)
 - e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic

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- range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
- f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
 - g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
15. All configurations shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dipswitches are not acceptable.
- B. Wired On/Off Room Controllers shall include:
1. Dual voltage (120/277 VAC, 50/60 Hz) capable rated for 20A total load
 2. One or two relay configurations
 3. Simple 150 mA switching power supply - Only 4 100 series line voltage powered devices on a Cat 5e local network (LMRC-101, LMRC-102, LMPL-101, LMPB-100)
 4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
 5. Wattstopper product numbers: LMRC-101, LMRC-102
- C. Wired On/Off/0-10V KO Mount Dimming Room Controllers shall include:
1. Dual voltage (120/277 VAC, 50/60 Hz) capable rated for 10A total load, or 16A total load depending on product.
 2. Optional real time current and voltage metering (with - M Monitoring option).
 3. One or two relay configurations (10A) or one relay configuration (16A)
 4. Smart 150 mA switching power supply
 5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
 6. One dimming output per relay
 - a. 0-10V Dimming - Where indicated, 0-10 volt analog outputs per relay for control of compatible ballasts and LED drivers. Units shall include a complimentary UL 924 rating for the ability of the 0-10 volt output to automatically open upon loss of power to the Room Controller to assure full light output from lighting connected to the 0-10V signal and powered by a live line voltage circuit.
 7. Units capable of providing both Class 1 and/or Class 2 wiring for the 0-10V output
 8. Wattstopper product numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M, or LMRC-111-16M
- D. Wired On/Off/0-10V Dimming Enhanced Room Controllers shall include:
1. Dual voltage (120/277 VAC, 50/60 Hz) capable or 347 VAC, 50/60 Hz. 120/277 volt models rated for 20A total load; 347 volt models rated for 15A total load
 2. Built in real time current monitoring via transducer
 3. One, two or three relay configurations
 4. Smart 250 mA switching power supply
 5. Conduit adaptor available for applications where all wiring must be in conduit.
 6. Four RJ-45 DLM local network ports. Provide integral strain relief
 7. One dimming output per relay
 - a. 0-10V Dimming - Where indicated, 0-10 volt analog outputs per relay for control of compatible ballasts and LED drivers. Units shall include a complimentary UL 924 rating for the ability of the 0-10 volt output to automatically open upon loss of power to the Room Controller to assure full light output from lighting connected to the 0-10V signal and powered by a live line voltage circuit.
 8. Wattstopper product numbers: LMRC-211, LMRC-212, or LMRC-213 (add -347 for Canadian voltage versions).
- E. Wired On/Off/ Forward Phase Dimming Room Controllers shall include:
1. Dual voltage (120/277 VAC, 50/60 Hz) rated for 20A total load, with forward phase dimmed loads derating to 16A for some load types
 2. Built in real time current monitoring via transducer
 3. One or two relay configurations

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4. Smart 250 mA switching power supply
 5. Conduit adaptor available for applications where all wiring must be in conduit.
 6. Four RJ-45 DLM local network ports. Provide integral strain relief
 7. One dimming output per relay
 - a. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads.
 8. Wattstopper product numbers: LMRC-221, LMRC-222
- F. Fixture Controllers shall include:
1. Product rating and form factor allows OEM fixture manufacturers to mount the device inside the interior cavity of standard-sized fluorescent or LED general lighting fixtures.
 2. One 3A 120/277V rated mechanically held relay.
 3. Require 7 mA of 24VDC operating power from the DLM local network.
 4. Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the DLM local network to drive accessory devices.
 5. Power to drive the LMFC Fixture Controller electronics can come from any wired Load Controller, LMPB-100 Power Booster and/or LMZC-301 Zone Controller (described later in the LMCP LIGHTING CONTROL PANELS specification section).
 6. 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller to assure full light output from lighting connected to the 0-10V signal and powered by a separate live line voltage circuit.
 7. Connect to a single or dual RJ-45 adaptor with 24 inch24-inch leads. Single adaptor mounts in a 1/2 inch1/2-inch KO and dual adaptor mounts in a 2.2 by 1.32 inch rectangular hole for connection to the DLM local network.
 8. Adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.
 9. A complete set of dimming features described above in the paragraph detailing On/Off/Dimming Enhanced Room Controllers.
 10. Wattstopper product numbers: Fixture Controller: LMFC-011, DLM Cable Connector: LMFC-RJ-50-24 or LMFC-2RJ, Power Booster: LMPB-100.

2.04 WIRED DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- A. Wired Digital Occupancy Sensors with two waytwo-way digital communications to Lighting Control system. Provide sensors of quantity and type to meet specific room applications. Features include the following:
1. Digital communication and pushbutton configuration of the following variables:
 - a. Sensitivity, 0-100 percent in 10 percent increments
 - b. Time delay, 1-30 minutes in 1 minute increments
 - c. Test mode, Five second time delay
 - d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 2. Load parameters settings include Auto or Manual-ON and blink warning.
 3. Programmable control functionality including:
 - a. Each sensor may be programmed to control specific loads within a local network.
 - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes or implementing a Partial On or Partial Off Sequence of Operation.
 - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period (default 10 seconds) after turning off.

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- d. On dual technology sensors, independently configurable trigger modes available for both Normal (NH) and After Hours (AH) time periods. The trigger and retrigger modes can be programmed to use the following technologies options:
 - 1) Ultrasonic and Passive Infrared
 - 2) Ultrasonic or Passive Infrared
 - 3) Ultrasonic only
 - 4) Passive Infrared only
 - e. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal and After Hour time periods.
- 4. One or two RJ-45 port(s) for connection to DLM local network.
- 5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
- 6. Device Status LEDs, which may be disabled for selected applications, including:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
- 7. Optional lens configurations for the PIR only Wall and Ceiling sensors to allow coverage of longer ranges, 1 way or 2 way aisles, higher density coverage in smaller areas, or mounting up to 40 foot heights
- 8. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
- 9. Manual override of controlled loads is permitted.
- 10. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
 - 1. Detection state for each sensor
 - 2. Detection state for all sensors in room (Room status)
 - 3. Occupancy sensor time delay
 - 4. Occupancy sensor sensitivity, PIR and Ultrasonic
- C. Units shall not have any dip switches or potentiometers for field settings
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- E. Wattstopper product numbers: LMPX-100 (optional -1, -3, -4), LMDX-100, LMPC-100 (optional -1, -5), LMUC-100-2, LMDC-100

2.05 WIRED DIGITAL WALL SWITCH OCCUPANCY SENSORS

- A. Wired Digital Wall switch Occupancy Sensors with two way digital communications to Lighting Control system. Provide sensors of quantity and type to meet specific room applications. Features include the following:
 - 1. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and verification.
 - 2. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity: 0-100 percent in 10 percent increments
 - b. Time delay: 1-30 minutes in 1 minute increments
 - c. Test mode: Five second time delay
 - d. Detection technology: PIR only or Dual Technology with PIR and Ultrasonic.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 - 3. Programmable control functionality including:

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- a. Each sensor may be programmed to control specific loads within a local network.
 - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period (default 10 seconds) after turning off.
 - d. On dual technology sensors, independently configurable trigger modes are available for both Normal and After Hours time periods. The trigger and retrigger modes can be programmed to use the following technologies options:
 - 1) Ultrasonic and Passive Infrared
 - 2) Ultrasonic or Passive Infrared
 - 3) Ultrasonic only
 - 4) Passive Infrared only
 4. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal and After Hour time periods.
 5. Two RJ-45 ports for connection to DLM local network.
 6. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
 7. Device Status LEDs including
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 8. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
 9. Assignment of integral buttons on the device to specific loads or scenes within the room without wiring or special tools
 10. Manual override of controlled loads
 11. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
1. Detection state
 2. Occupancy sensor time delay
 3. Occupancy sensor sensitivity, PIR and Ultrasonic
 4. Button state
 5. Switch lock control
 6. Switch lock status
- C. Units shall not have any dip switches or potentiometers for field settings.
- D. Multiple wall switch occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- E. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
1. Left button, Tap - Turn load on: Press and hold - Raise dimming load.
 2. Right button, Tap - Turn load off: Press and hold - Lower dimming load
- F. Low voltage momentary pushbuttons shall include the following features:
1. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 2. The following button attributes may be changed or selected using a wireless configuration tool:
 - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

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- b. Individual button function may be configured to Toggle, On only, Off only, or Toggle Dim (toggles between press and hold to raise, release, then press and hold to lower).
- c. Individual scene buttons may be locked to prevent unauthorized change.
- d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours in preset increments.
- e. Ramp rate may be adjusted for each dimmer switch.
- f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
- g. Wattstopper part numbers: LMPW-101 or -102, LMDW-101 or -102. Pre-engraved versions with most requested text available by adding a "-ENG#" before the final color suffix. Available in white, light almond, ivory, grey, red, and black; compatible with wall plates with decorator opening. All engraving and color requirements shall be called out on Reflected Ceiling plans.

2.06 WIRED DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 multiple button and rocker configurations. Wall switches shall include the following features:
 - 1. Buttons used are used to control loads in a room, trigger scenes in a room, or control a network group of loads. Rockers are used to raise or lower the level of loads in a room.
 - 2. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
 - 3. Removable buttons/rocker insert for field replacement with engraved and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall, only the switch plate.
 - 4. Configuration LED on each switch that blinks to indicate data transmission.
 - 5. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 - d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
 - 6. Programmable control functionality including:
 - a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life force on safety or functions associated with the other priority levels.
 - b. Scenes patterns may be saved to any button other than dimming rockers. Once set, individual buttons may be digitally locked to prevent overwriting of the preset levels by an occupant in the room.
 - 7. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
 - 1. Button state
 - 2. Switch lock control
 - 3. Switch lock status
- C. Two RJ-45 ports for connection to DLM local network.
- D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.
- E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
 - 1. Individual button function may be configured to Toggle, On only, Off only, or , or Toggle Dim (toggles between press and hold to raise, release, then press and hold to lower).
 - 2. Individual scene buttons may be locked to prevent unauthorized change.

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3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours in preset intervals.
 4. Ramp rate may be adjusted for each dimmer.
 5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
- F. Manufacturer shall offer Pre-Engraved devices with the most requested text engravings that can be readily shipped direct from inventory and shall be designated with an "ENG#" suffix before the color descriptor.
- G. Wattstopper product numbers: Standard 200 Series (2nd digit = # buttons, 3rd = # rockers): LMSW-210, LMSW-211, LMSW-220, LMSW-222, LMSW-241, LMSW-250. Original 100 Series: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Pre-engraved 100 series versions with most requested text available by adding a "-ENG#" before the final color suffix. Available in white, light almond, ivory, grey, red, and black; compatible with wall plates with decorator opening. All engraving and color requirements shall be called out on Reflected Ceiling plans.

2.07 WIRED DIGITAL DAYLIGHTING SENSORS

- A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
 2. Open loop sensors measure incoming daylight in the space and can control up to three lighting zones.
- B. Digital daylighting sensors shall include the following features:
1. Sensor's internal photodiode shall only measure light within the visible spectrum. The photodiode's spectral response curve shall closely match the photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 or greater than 700 nanometers.
 2. Sensor light level range shall be from 1-1,533 foot-candles (fc).
 3. Capability of ON/OFF, bi-level, tri-level, or dimming for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
 4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband (separation, between the "ON Setpoint" and the "OFF Setpoint") to prevent the lights from cycling on and off excessively.
 5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
 6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
 7. Photosensors shall provide adjustable cut-off time. Cut-off time defined as the number of selected minutes the load is at the minimum output before the load turns off. Selectable range of 0-240 minutes including option for no cut-off.
 8. Wall switch functions so occupants may always reduce lighting level to increase energy savings or, if permitted by facility engineer, optionally raise lighting levels for a selectable period or cycle of occupancy above daylight cap level.
 9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool.
 10. Configuration LED status light on device blinks to indicate data transmission.
 11. Status LED indicates test mode, override mode and load binding.
 12. Recessed switch on device to turn controlled load(s) ON and OFF.

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13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
 - a. Light level
 - b. Day and night setpoints
 - c. Off time delay
 - d. On and off setpoints
 - e. Up to three zone setpoints
 - f. Operating mode - on/off, bi-level, tri-level or dimming
 14. One RJ-45 port for connection to DLM local network.
 15. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2).
 16. Any load or group of loads in the room can be assigned to a daylighting zone.
 17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
 18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.
- C. Closed loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
 2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
 3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
 4. Wattstopper Product Number: LMLS-400, LMLS-400-L.
- D. Open loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).
 2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
 3. Each of the three discrete daylight zones can include any non-overlapping selection of loads in the room.
 4. Wattstopper Product Number: LMLS-500, LMLS-500-L.

2.08 WIRED DIGITAL INPUT AND OUTPUT LOW VOLTAGE CONTROL MODULES

- A. Wired DLM input and output low voltage modules allow control of DLM loads by other devices and systems or allow the DLM system to send signals to other devices and systems for integration. Interfacing with other systems can either be a dry (unpowered/with no voltage) contact closure, or via RS-232.
- B. Modules shall be plastic with a clamshell hinged lid, two Cat 5e wiring terminals for connection to a DLM wired Cat 5e IRB network and come with an accessory DIN mounting bracket. LEDs on the unit shall provide information on the status of the inputs or outputs, and a configuration button shall be provided to allow easy entry into Push 'n Learn(tm) programming sequence.

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Devices shall include a removable terminal block for ease of wiring, and label identifying each terminal contact.

- C. Wired Low Voltage Room Occupancy Status Isolated Relay Interface:
 - 1. Module provides a single Form C contact relay rated for 24VAC/DC.
 - 2. Relay module will provide a contact closure on the Normally Open side of the relay (and contact open on the Normally Closed side) when any occupancy sensor on the local Cat 5e IRB network is in the occupied mode. This function is non-programmable and works automatically via the unit's internal circuitry.
 - 3. LED on the device to provide status of the relay
 - 4. This device is ideally suited to connect to HVAC controls in the space that are looking for a dry contact whenever the space is occupied to enhance their specific sequence of operation.
 - 5. Wattstopper product number LMRL-100
- D. Wired Low Voltage Output Module features shall include:
 - 1. Two individual Form C contact relays rated from 0-24VAC/DC.
 - 2. Module relays shall act like line voltage relays in DLM Load Controllers; they can be assigned (bound) to any DLM system input including switch buttons, occupancy sensors, photocells, timeclocks, and/or low voltage input modules.
 - 3. In addition to providing a maintained contact, relays can be set to a "pulse" mode so that when turning on they stay on only for a short duration and then they automatically return to their normally Open state, allowing the module to interact with other devices that require momentary inputs from 0.1 to 25.4 or 1-254 seconds.
 - 4. Unit shall have two override buttons so each relay can be manually overridden On and Off to verify wiring and operation.
 - 5. LEDs on the device to identify status of the device's two relays.
 - 6. Wattstopper product number LMOR-102
- E. Wired Low Voltage Input Module features shall include:
 - 1. Ability to switch the module between three operating modes, allowing it to be used as a load control device (Normal use), a partition interface device, or an input for skylight or exterior photocells.
 - 2. When set in normal usage, the DLM Input Module shall accept up to 4 separate inputs, either 2-wire maintained, 2-wire momentary, or 24VDC signal inputs. Additionally, a pair of 2-wire inputs can be used as a 3-wire input to emulate up and down presses on a DLM switch rocker.
 - 3. In normal usage, the 4 inputs can be used to control loads, trigger a scene, send a network group command, or emulate an occupancy action so an occupied/unoccupied message is sent to loads.
 - 4. Input modules can trigger special load scenarios, taking advantage of DLM system's priority-based functions such as Force On, Force Off, Shed, Cleaning, Normal/After Hours, and Key Switch functions.
 - 5. Inputs can trigger different load and scene modes for controlled outputs, so loads can toggle status, go on, go off, or toggle dim. Scenes can be set to Recall, Recall/Off, or Scene Off.
 - 6. In partition mode, unit will send appropriate command to indicate whether movable partitions (up to 4) in the space are in the extended or retracted state and then changing the profile settings of the room allowing different bindings of switches, dimmers, and occupancy sensors (see "Section 2.17 Wired Digital Partition Controls" for more info).
 - 7. In exterior photocell mode, will provide an input for an external photocell to provide the system with a sensed footcandle (fc) level. This fc level can be used by DLM scheduling devices to determine when a group of loads should be turned on or off based on daylight level instead of dusk/dawn settings.
 - 8. All listed functionality to be accessible from IR handheld remote or from front end system software. Products that require functions to be set at the device, or that incorporate dip switches to select functions, shall not be allowed.

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9. Wattstopper product number LMIN-104. Optional photocell part numbers LMPO-200 for exterior, or LMPS-6000 for skylight.
- F. Wired RS-232 Interface Module features shall include:
1. Ability to communicate with other devices and systems via standard RS-232 wiring and protocol.
 2. Via a standardized set of host commands, other systems can send messages to a RS-232 Interface Module in a DLM room, allowing loads to be overridden on, off or sent to a specific level (taking advantage of optional message parameters to dim over time), set scene, execute button lockout, changing room profiles, or sending a Normal Hours/After Hours command.
 3. By using the "Status" host command the RS-232 interface module can be instructed to share information with connected systems whenever changes occur in the room. Examples of message alerts include relay status change, occupancy status change (by room or by sensor), scene status change, buttons are pressed, or profile's change based on partitions, or daylight level.
 4. Wattstopper product number LMDI-100

2.09 WIRED OR HYBRID ROOM HANDHELD CONFIGURATION TOOL

- A. Provide handheld configuration tool to facilitate customization of Wired DLM devices using two-way infrared communications. Can be used with or without PC software that connects to each local network via a USB interface (LMCS described later).
- B. Features and functionality of the handheld configuration tool shall include:
 1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
 2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
 3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
 4. Save up to eight occupancy sensor setting profiles and apply profiles to selected sensors in same room or other rooms.
 5. Adjust current light level of any load(s) on the local network and capture those levels in scene setting. If fixtures with DLM tunable white Blanco devices are present in room, handheld can also adjust their CCT level.
 6. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings, enable or disable load shed status, and identify all IRB connected devices by their part number, and hardware/firmware versions.
 7. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
 8. Verify status of Bridge Devices connected to Wired or Wireless Segment networks.
- C. Wattstopper Product Numbers: Handheld LMCT-100-2

2.10 DLM SEGMENT NETWORK TYPES

- A. DLM shall allow for three separate types of Room-to-Room ("Segment") communication so that information may be shared between them and any front-end hardware. The system shall allow either Wired, Wireless, or both Wired and Wireless (Hybrid) Room-to-Room Segment Networks communication types to be used.
- B. For a wired Segment Network, provide a linear topology, BACnet-based MS/TP conductor to connect DLM local IRB networks (rooms) and LMCP relay panels to allow for centralized control.
 1. Each connected DLM local room network shall include a single network bridge (LMBC-300). The network bridge is the only room-based device that is connected to the segment network.

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2. Network bridges, relay panels or network controllers with integral network bridges, shall include a terminal block with provisions for separate "in" and "out" terminations, for Wired segment network wire connections.
 3. Wired segment network utilizes 1.5 twisted pair, shielded, cable ordered from the lighting control manufacturer. Maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
 4. Network wire jacket for interior applications is available in high visibility green, white, or black. A black version for direct burial is also available.
 5. Substitution of manufacturer-supplied cable is not permitted and may void the warranty if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
 6. Network signal integrity requires that each conductor, ground wire and shield be correctly prepared and terminated at every connected device. Use of crimp on ferrules are highly recommended for each individual wire termination.
 7. Wired Segment networks shall be capable of connecting to any of the following: BACnet-compliant BAS (provided by others) directly via MS/TP, or BACnet/IP via an NB-ROUTER, or LMJA-8xxx-SM Segment Manager (which can also accept BACnet/IP). Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.
 8. Wattstopper Product Number: Room Bridge for Wired Segment Networks: LMBC-300. Wired Segment Communication wire: LM-MSTP, LM-MSTP-W, LM-MSTP-B, LM-MSTP-DB
- C. For a wireless Segment Network, wireless Load Controllers, wireless fixture sensors, and/or wireless Bridges shall communicate with each other, or to a Border Router to create a IPv6 network.
- D. A Hybrid Segment Network indicates that both wired and wireless networks are being used to connect different areas of the building to the front end hardware. Each individual Segment in the network will either a wired segment, or a wireless segment, and by integrating the two networks with standard ethernet hardware the two networks will be able to exchange information with each other and, if needed, any other automation systems.

2.11 WIRELESS NETWORK BRIDGES, LOAD CONTROLLERS AND BORDER ROUTERS

- A. Wireless Network Bridges shall connect to Wired DLM room devices via a local In Room Bus (IRB), or a mix of Wired and Wireless DLM room devices forming a hybrid room. Wireless Load Controllers shall have an integral wireless bridge capability allowing them to connect to only Wireless room devices, forming a Wireless room. The Wireless Bridges and the Wireless Load Controllers will use an IEEE 802.15.4 6LoWPAN mesh network for communication between rooms and a Border Router that oversees the formation and configuration of the overall wireless network.
- B. Features of the Wireless Network Bridges shall be as follows:
1. Network bridge shall be provided as a separate module connected on the local IRB network through an available RJ-45 port.
 2. Wireless Bridges provide Plug 'n Go(tm) operation to automatically discover room devices connected to the local network and make all device parameters visible to the Border Router via the wireless network.
 3. Wireless Bridges shall incorporate dual internal omni-directional antennas with diversity to provide wide and robust communication. Antennas are inside the bridge to protect them against accidental contact with other objects.
 4. Tri-color LEDs shall be included on the bridge to provide feedback about the local Cat 5e IRB network (red), wireless network health (blue), and to help identify during commissioning (white).
 5. Wireless Boarder Routers shall automatically create standard BACnet objects for selected DLM devices allow any BACnet-compliant BAS to use lighting control and power

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monitoring data provided by the DLM devices on each local network. Products requiring that an application-specific point database be loaded to create or map BACnet objects, or those not capable of providing BACnet data for control devices via a dedicated BACnet Device ID per room are not acceptable. Standard BACnet objects shall be provided as follows:

- a. Read/write the normal or after hours schedule state for the room
- b. Read the detection state of each occupancy sensor
- c. Read the aggregate occupancy state of the room
- d. Read/write the On/Off state of loads
- e. Read/write the dimmed light level of loads
- f. Read total current in amps, and total power in watts through the load controller
- g. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
- h. Activate a preset scene for the room
- i. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells
- j. Set daylight sensor operating mode
- k. Read/write wall switch lock status
- l. Read watts per square foot for the entire controlled room
- m. Write maximum light level per load for demand response mode
- n. Read/write activation of demand response mode for the room
- o. Activate/restore demand response mode for the room

C. Features of the Wireless Border Router shall be:

1. The Wireless Border Router shall manage the formation and configuration of the IPv6 6LoWPAN wireless segment mesh network and provide connectivity via wired 10/100 Ethernet to a local area network that may include a LMJA-8xxx-SM JACE appliance, Wireless cellular modem, or Building BAS System.
2. Border Router shall provide key information about the health of the mesh network in the form of signal quality, device status, network status, and other real-time network information such as energy monitoring.
3. The LMBR-650 shall have dual internal omni-directional antennas with diversity to ensure reliable communication with Wireless Network Bridges and/or Wireless Load.
4. Border Router shall include a Real-time clock with supercap back-up. Border Router shall get power for operation via a 120V outlet (in non-plenum applications), or a dedicated DLM LMPB-100 Power Booster connected to a Cat 5e to DC barrel connector (for plenum applications).

D. Communication between the Wireless Network Bridges, the Wireless Load Controllers, and the Border Router:

1. Communication between the Wireless Bridges, the Wireless Load Controllers, and the Border Router shall be via a standalone wireless mesh network that does not require interface with any other wireless network in the space. The mesh network shall allow communication between all rooms as long as non-battery powered wireless devices are within 100' of each other.
2. Wireless Bridges shall communicate over a IPv6 6LoWPAN 2.4 GHz IEEE 802.15.4 network and use AES128 Encryption.
3. Wireless protocol shall allow BACnet communication to be transported transparently between the Wireless Network Bridges and Wireless Load Controllers to any front end BAS devices, i.e., LMJA-8xxx-SM JACE device.

E. Wattstopper product numbers: Wireless Network Bridge LMBC-650. Wireless Load Controllers: 10A Room Controllers LMRC-611MCC or LMRC-611MCC-A, 16A Room Controller LMRC-611-16M, 20A Plug Load Controller LMPL-611-20M, Wireless Fixture Sensor LMFA-601-W. Wireless Border Router: LMBR-650.

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2.12 WIRED NETWORK BRIDGE

- A. Network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a front end network controller or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. Network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
1. Network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
 2. Provide Plug n Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the Network Controller via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
 3. Network bridge shall support digital communications to facilitate the control of all devices in its local Cat 5e network to provide interoperability with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
 - a. Bridge shall have provision for an individual BACnet device ID and shall support the full 2²² range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
 - b. Bridge shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
 - c. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote.
 - d. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
 - e. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and afterhours, respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (<http://www.bacnet.org/Addenda/Add-135-2010aa.pdf>)
 4. Network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
 - a. Read/write the normal or after hours schedule state for the room
 - b. Read the detection state of each occupancy sensor
 - c. Read the aggregate occupancy state of the room
 - d. Read/write the On/Off state of loads
 - e. Read/write the dimmed light level of loads
 - f. Read the button states of switches
 - g. Read total current in amps, and total power in watts through the load controller
 - h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
 - i. Activate a preset scene for the room
 - j. Read/write daylight sensor fade time and day and night setpoints
 - k. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells

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- l. Set daylight sensor operating mode
- m. Read/write wall switch lock status
- n. Read watts per square foot for the entire controlled room
- o. Write maximum light level per load for demand response mode
- p. Read/write activation of demand response mode for the room
- q. Activate/restore demand response mode for the room

B. Wattstopper product numbers: LMBC-300.

2.13 LMCP-10V ON/OFF/0-10V LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

- A. Hardware: Provide LMCP lighting control panels with On/Off relays and 0-10V terminals in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction with the following components:
1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8, 1 - 24, or 1 - 48 relays and 0-10V dimming outputs. 24 and 48 size panels shall also have space for up to 6 four-pole contactors at the bottom of the panel.
 2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP-xx-10V panel cover shall have a hinged and lockable door to restrict access to line voltage section of the panel.
 3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. For each relay a 0-10V output shall be available on the relay driver board. Panel interiors shall include the following features:
 - a. Removable, plug-in terminal blocks with connections for all 0-10V wiring terminations.
 - b. Override pushbutton (providing On/Off and Dimming capability) and LED ON/OFF status for each relay.
 - c. Digital inputs (two pairs of RJ-45 jacks) shall support all Wired DLM digital switches, dimmers, input and/or output modules, daylighting sensors; occupancy sensors, and additional load controllers. Inputs are divided into two separate digital networks (A and B), each capable of supplying 250mA to connected devices.
 - d. Relay and 0-10V output states shall be available to external control devices and systems via BACnet.
 - e. Automatically sequenced operation of relays to reduce impact on the electrical power input when large load groups are controlled together.
 - f. Group control of relays shall be provided through an interface to the DLM LMCT handheld configuration tool. Each relay and 0-10V output can be associated with a group for direct on/off or dimming control or scene control via a simple programming sequence using the relay override pushbuttons for groups 1-8 or via LMCT for groups 1-99.
 - g. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
 4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
 - a. Electrical:
 - 1) 30 amp ballast at 277V, 20 amp ballast at 347V
 - 2) 16 amp E-Ballast at 120V, 10 amp E-Ballast at 277V
 - 3) 20 amp tungsten at 120V
 - 4) 30 amp resistive at 347V
 - 5) HP motor at 120V
 - 6) 20 amp at 120V for Receptacle Loads
 - 7) 14,000 amp short circuit current rating (SCCR) at 347V

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- 8) Relays shall be UL 20 listed for control of plug loads
- b. Mechanical:
 - 1) Replaceable, 1/2 inch KO mount with Class 2 wire harness and single 5-pin phenolic connector.
 - 2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
 - 3) Dual line and load terminals each support two #12 - #14 solid or stranded conductors.
 - 4) Capable of to 300,000 mechanical on/off cycles.
 - 5) Internal ferrite to prevent electrical noise on low voltage wires.
 - 6) Isolated low voltage contacts provide for relay status feedback and pilot light indication
5. A 0-10V output shall be provided per relay. This output is linked to its individual relay, so they're controlled together automatically. The 0-10V signal from the panel shall meet requirements of NEMA ANSI C82.11-2011 - Annex A allowing it to control any fixtures providing a 0-10V control signal such that 10V or higher will drive the light to maximum, and 1V or less will drive the light to minimum output. A linear dimming curve is used between these levels.
6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as needed to meet the project requirements. Power supply to have internal over-current protection with automatic reset and MOV protection.
7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic bypass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700. Relay Driver Cards providing 0-10V control shall automatically open their 0-10V single on loss of normal power, ensuring connected fixtures powered by a different source shall go full on.
8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
 - a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 networked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
 - b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
 - c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery backup for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
 - d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
 - 1) Scheduled ON (or Goto Level)/ OFF
 - 2) Manual ON / Scheduled OFF
 - 3) Astro ON / OFF (or Photo ON / OFF)
 - 4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
 - e. User interface shall be a portable IR handheld configuration tool for any panel in the system (LMCT-100-2) or Front End System Software.
 - f. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
 - g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel should

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- segment network communication be lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
9. Lighting control panel can operate as a stand-alone device supporting schedule, group, and photocell functions or as a networked device via a Wired room-to-room segment network.
 10. Lighting control panel shall support digital communications to facilitate interoperability with building automation systems and other intelligent field devices through an integral digital Wired Network Bridge on the panel's intelligence board. All features associated with the LMBC-300 Wired Network Bridge shall extend to the panel and its controlled loads, and all devices connected to the panel by Cat 5e local IRB network. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
 11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available. This panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
 - a. Use the same intelligence board as the LMCP relay panel.
 - b. Shall not include relay driver boards or relays, or 0-10V outputs.
 - c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
 - d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of two available DLM local IRB networks.
 - e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays and 0-10V outputs.
 12. For retrofit applications, or where direct low voltage override switches and pilot contacts are required, an LMCP panel with only On/Off capability can be provided using On/Off relay driver cards. These cards are NOT capable of providing 0-10V outputs but will include a removable terminal that provides a direct wired switch inputs associated with each relay (2-wire momentary switches only) and a pilot output.
 13. Wattstopper Product Number: On/Off/0-10V Relay Panels: LMCP-8-10V, LMCP-24-10V, LMCP-48-10V; On/Off Only Relay Panels: LMCP-8, LMCP-24, or LMCP-48; Zone Controller: LMZC-301.
- B. User Interface: Each system of lighting control panels shall be supplied with at least one handheld configuration tool (LMCT-100-2). As a remote programming interface, the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:
1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
 2. Relay Group creation of up to 99 groups. Group creation shall be capable of programming of programming seven key relay parameters for member relays. The seven parameters are: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
 3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive and shall be configurable as to whether the event is active on holidays. Holidays can also be defined through the User Interface.
 4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive and shall be configurable as to whether the event is active on holidays.

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5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. Wattstopper Product Number: LMCT-100-2

2.14 FRONT END NETWORK CONTROLLER WITH SEGMENT MANAGER STATION

- A. For networked applications, the Digital Lighting Management system can include one or more Front End Network Controllers with Segment Manager Interface (referred to as a Network Controller below) to manage network communication. It shall be capable of serving up a user interface to a standard web browser.
- B. Each Network Controller shall have integral support for two wired MS/TP segment networks. Segment networks may alternately be connected to the Network Controller via external BACnet/IP interface routers or Wireless Border Routers and Network switches using Ethernet structured wiring. Each router shall accommodate one "segment" - respectively a wired MS/TP run or Wireless Mesh Segment Network. Provide the quantity of routers and switches as shown on the Drawings.
- C. Operational features of the Network Controller shall include the following:
 1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
 2. Easy to use graphical user interface, compatible with current Chrome or equivalent browser. The Network Controller shall not require installation of any lighting control software on an end-user PC, but if Manufacturer's Lighting Control Software is installed, it shall be able to work in tandem with the Network Controller without issue.
 3. Log in security capable of restricting some users to view-only or other limited operations.
 4. Network Controller with N4 operating systems shall include two main sets of interface screens - those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system and provide a centralized scheduling interface. Capabilities using the Config Screens shall include:
 - a. Automatic discovery of DLM devices and relay panels on the segment network(s). Discovery function shall provide communication, monitoring or control of all local devices and lighting control panels.
 - b. Allow information for all discovered DLM devices to be imported into the Network Controller via a single XML based site file from the Wattstopper LMCS Software, reducing the time needed to make a system usable by the end user. Importable information can include text descriptions of every DLM component and individual loads, and automatic creation of room location information and overall structure of DLM network. Info entered in LMCS should not have to be re-entered manually via keystrokes into the Network Controller
 - c. After discovery, all rooms and panels shall be presented in a standard navigation tree format. User selection of a device in the tree will allow its settings and operational parameters to be viewed and changed.
 - d. Ability to view and modify DLM device operational parameters. It shall be possible to set device parameters independently for normal hours and after-hours operation including sensor time delays and sensitivities, and load response to sensor of Manual-On or Auto-On.
 - e. Provide capabilities for integration with a BAS via BACnet protocol. Depending on project hardware, previously mentioned BACnet points shall be available to the BAS via BACnet/IP connection to the Network Controller: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug load power; load dimming level. BACnet items shall be capable of being moved into an "Export Table" that will provide any integrator with

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only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance.

5. Capabilities using the Network Controller with N4 operating system's Dashboard Screens shall include:
 - a. Ability to set up schedules for DLM local networks (rooms) and panels. Schedules shall be capable of controlling individual rooms or groups of loads with either on/off or normal hours/after hours commands. Support for annual schedules, holiday schedules and unique date-bound schedules, as well as Astro On or Astro Off events with offsets. Schedules shall be viable graphically as time bars in a screen set up to automatically show scheduled events by day, week, or month.
 - b. For fixtures that have CCT capability as specified under paragraph "Digital Wall Switch and Timer For Correlated Color Temperature", the Network Controller will provide schedule functionality similar to the CCT Wall Timer.
 6. If indicated by the Drawings, Network Controllers shall be integrated into a larger overall network by the addition of a Network Supervisor package. The Supervisor is a server level computer running a version of the Network Controller software with dedicated communication and networking capability, able to pull information automatically from each individual Network Controller. Using a Supervisor, information from individual Network Controllers can be accessed and stored on the Supervisor's hard drive, eliminating the risk of data being overwritten due to Network Controller memory limits.
- D. Wattstopper Product Numbers: NB-ROUTER, LMJA-8125-SM, LMJA-8300-SM, LM-SUPERVISOR, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.15 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

- A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or all products over a wired or wireless segment network utilizing standard BACnet/IP communication.
- B. Additional parameters exposed through this method include but are not limited to:
 1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
 2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
 3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
 4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
 5. Separate normal hours and after hours per-load button mode with modes including Do nothing, on only, off only, on and off.
 6. Load control polarity reversal so that on events turn loads off and vice versa.
 7. Per-load DR (demand response) shed level in units of percent.
 8. Load output pulse mode in 254 steps either 0.1 seconds or 1 second.
 9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.
- C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
 1. Device list report: All devices in a project listed by type.
 2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.

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3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
 4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
 5. Device parameter report: Per-room lists of all configured parameters accessible via handheld IR programmer for use with O&M documentation.
 6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
 7. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.
- D. Network-wide programming of parameter data in a spreadsheet-like Network Grid programming environment including but not limited to the following operations:
1. Set, copy/paste an entire project site of sensor time delays.
 2. Set, copy/paste an entire project site of sensor sensitivity settings.
 3. Search based on room name and text labels.
 4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
 5. Filter by parameter value to search for product with specific configurations.
- E. Network-wide firmware upgrading remotely via the BACnet/IP network.
1. Mass firmware update of entire rooms.
 2. Mass firmware update of specifically selected rooms or areas.
 3. Mass firmware upgrade of specific products
- F. Wattstopper Product Number: LMCS-100, LMCI-100

2.16 OPENADR DEMAND RESPONSE SOLUTION

- A. If the project's lighting control system includes Wired or Wireless networking capability to all rooms from a front end hardware station, the system can respond to BACnet demand response commands from other systems acting as a Virtual End Node (VEN) that are integrated with the lighting systems front end controls:
- B. For sites that do not plan on integrating the lighting controls with a separate on premise Virtual End Node and wish the lighting control system to be a standalone VEN that can communicate via OpenADR 2.0b, lighting control manufacturer shall provide a solution using Cloud communication capability between the grid operator's Virtual Top Node (VTN) and the Lighting Control System via a cellular hardware called out in Section 1.12 as RACCESS remote access platform, or via a Public IP connection.
- C. Wattstopper Product Numbers: RACCESS: LMDR-VEN, Public IP: LMDR-VEN-VPN.

2.17 0-10V INPUT PHASE CONVERTERS

- A. When a project has loads that require phase dimming instead of 0-10V dimming, include 0-10V interface devices that monitors a 0-10V signal from a room controller and, using that as an input, will alter the electrical sine wave to the loads by forward phase (leading edge) or reverse phase (trailing edge) dimming. These devices are interfaces acting on the line voltage circuits and will not have to communicate to other DLM devices in the area via Cat 5e or wireless communication.
- B. Use an interface device with two ½-inch KO mounting nipples – one for the incoming and exiting line voltage circuit, and the other for the 0-10V signaling wires. Unit will automatically sense whether the line voltage circuit is 120 or 277VAC and provide a reverse phase only dimming switchleg. This device will handle loads of 450W for 120V and 1000W for 277V and have a molded polycarbonate body. Wattstopper part number LDCM-PL-120-277-010V.
- C. Use an interface device that uses a slotted bracket for surface mounting and is rated for install in plenum spaces. The device will automatically determine optimum dimming type for the load of either forward or reverse phase. This device will handle loads of 750W for 120V and 1300W for 277V. Wattstopper part number BF-SDS10V-AST

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2.18 EMERGENCY LIGHTING CONTROL DEVICES

- A. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides ON/OFF control of emergency lighting based on status of associated normal lighting. Upon normal power failure the emergency lighting relay will close, forcing the emergency lighting ON until normal power is restored. Features include:
 - 1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
 - 2. Push to test button
 - 3. Auxiliary contact for remote test or fire alarm system interface
- B. Wattstopper Product product Numbers: DIN Rail Mount: ELCU-100, 1/2 inch KO Mount: ELCU-200.

PART 3 EXECUTION

3.01 PREPARATION

- A. Do not begin installation until measurements have been verified and work areas have been properly prepared.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.02 INSTALLATION

- A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
- B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
 - 1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
 - 2. If fixtures have internal Wired Fixture Control Modules, ensure that they are also connected with Cat 5e cable. (Fixtures with Wireless Fixture Sensors do not require Cat 5e cables.)
 - 3. Install all Wired room-to-room network devices using manufacturer-sourced LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
 - 4. Low voltage wiring topology for each type of connector must comply with manufacturer's specifications.
 - 5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing, and topology in as built drawings.
- C. All line voltage connections shall be tagged to indicate circuit and switchleg designations. Junction box covers should also provide circuit and switchleg info.
- D. Test all devices to ensure they are powered and communicate properly with each other.
- E. Following manufacturer's recommendations, calibrate all sensor sensitivities and adjust mounting/locations to ensure proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
- F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
 - 1. Sequence of Operation, (e.g., Auto On, Partial ON, Partial Off, etc.)
 - 2. Load parameters (e.g., blink warning, group integrations, etc.)
 - 3. Sensor parameters, time delays, sensitivities, and daylighting setpoints.

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- G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.
- H. Tighten Class 1 conductors at circuit breaker and termination point to torque ratings marked on enclosure or device's UL label or installation instructions.
- I. Class 2 cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class 1 conductors shall enter a low-voltage area.
- J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads require separate neutrals and should not be mixed within any individual room controller or multiple 0-10V input phase converters .
- K. Verify all lighting loads to be free from short circuits prior to connection to room controllers or relays inside panels.
- L. Lighting Control installer to take steps needed to co-ordinate with the installer of the same manufacturer's Shade products to ensure both systems will be integrated into the room's local Cat 5e In Room Bus or Wireless communication network. Contractor to verify whether local Shade override devices should be mounted with those for the Lighting Control system. Each installer shall verify that their hardware has been set up properly for independent operation, and that once connected, still operates properly. The Lighting Control installer should verify if a single network communication bridge is to be installed in the room so both systems be connected to other rooms and a single set of front end devices.
- M. Remote Access for Network Systems: If "REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS" is specified in Part 1 of this specification, ensure DLM Network Cabinet (LMNC) is installed in a location with good to excellent cellular phone coverage based on building orientation and geographic location, mount magnetic antenna, and connect to the modem. When alternate mounting locations are not available and a stronger cellular signal is needed, the manufacturer shall offer additional antenna options to improve signal quality. Verify mounting location with Engineer and Owner prior to proceeding.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.
- B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
 - 1. Verify Class 1 and 2 wiring connections are terminated properly by validating system performance.
 - 2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
 - 3. Verify / complete task programming for all switches, dimmers, time clocks, occupancy sensors, daylighting controls, and input/output modules to meet project.
 - 4. Verify the control of each space complies with the Sequence of Operation. If no Sequence of Operation provided, manufacturer will set up based on best practices.
 - 5. Correct any system issues and retest.
- C. Provide a report in table format with drawings or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Include the following:
 - 1. Date of test or inspection.
 - 2. Loads per space, or Fixture or Wireless Device Address identification.
 - 3. Quantity and Type of each device installed.
 - 4. Reports providing each device's settings.

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3.04 COMMISSIONING ASSISTANCE

- A. Title 24 Acceptance Testing Service; Include additional costs for Lighting Control Manufacturer to provide a technician for one additional day while the CLCATT performs lighting control acceptance testing in accordance with CA TITLE 24 P6 including submission of required documentation.

3.05 DEMONSTRATION AND TRAINING

- A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
 1. Confirmation of entire system operation and communication to each device.
 2. Confirmation of operation of individual relays, switches, and sensors.
 3. Confirmation of system Programming, photocell settings, override settings, etc.
 4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.06 PRODUCT SUPPORT AND SERVICE

- A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION

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SECTION 262416

PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Lighting and appliance panelboards.
- B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2025.
- D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- E. NEMA PB 1 - Panelboards; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.
- G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 67 - Panelboards; Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

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- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- D. Manufacturer's equipment seismic qualification certification.
- E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB: www.electrification.us.abb.com/#sle.
- B. Eaton Corporation: www.eaton.com/#sle.
- C. Schneider Electric: www.se.com/#sle.
- D. Siemens Industry, Inc: www.new.siemens.com/#sle.
- E. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

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- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Copper.
 - 3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

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5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

2.05 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- I. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 260526.
- K. Install all field-installed branch devices, components, and accessories.
- L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- M. Provide filler plates to cover unused spaces in panelboards.
- N. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads. Also provide for the following:
 1. Fire detection and alarm circuits.
 2. Intrusion detection and access control system circuits.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.
- D. Test GFCI circuit breakers to verify proper operation.
- E. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

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- B. Adjust alignment of panelboard fronts.

3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 262726

WIRING DEVICES

PART 2 PRODUCTS

1.01 WIRING DEVICES - GENERAL REQUIREMENTS

- A. Provide wiring devices suitable for intended use with ratings adequate for load served.

END OF SECTION

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SECTION 262816.16

ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).
- C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.
- D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet (2,000 m).
 - 2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
- E. Horsepower Rating: Suitable for connected load.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- H. Provide with switch blade contact position that is visible when the cover is open.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- K. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
- L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- M. Heavy Duty Switches:
 - 1. Comply with NEMA BS 31047.
 - 2. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.

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- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 260526.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 265100

INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Ballasts and drivers.

1.02 RELATED REQUIREMENTS

- A. Section 260529 - Hangers and Supports for Electrical Systems.
- B. Section 260533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.
- B. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Provide photometric calculations where luminaires are proposed for substitution.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

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- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 016000 - Product Requirements.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

2.03 BALLASTS AND DRIVERS

- A. Ballasts/Drivers - General Requirements:
 - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- B. Dimmable LED Drivers:
 - 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

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3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Install accessories furnished with each luminaire.
- G. Bond products and metal accessories to branch circuit equipment grounding conductor.
- H. Emergency Lighting Units:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- I. Exit Signs:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- J. Remote Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.
- K. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

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SECTION 265600

EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Ballasts.

1.02 RELATED REQUIREMENTS

- A. Section 260529 - Hangers and Supports for Electrical Systems.
- B. Section 260533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
 - 2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 - 2. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
 - 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
- D. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

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1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
 - 1. LED Tape - General Requirements:
 - a. Listed.
 - b. Designed for field cutting in accordance with listing.

2.03 BALLASTS AND DRIVERS

- A. Ballasts/Drivers - General Requirements:
 - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- B. Dimmable LED Drivers:
 - 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

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3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires in accordance with NECA/IESNA 501.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Install accessories furnished with each luminaire.
- G. Bond products and metal accessories to branch circuit equipment grounding conductor.
- H. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.06 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

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SECTION 270533.13

CONDUIT FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Galvanized steel intermediate metal conduit (IMC).
- C. Galvanized steel electrical metallic tubing (EMT).

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
- D. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.
- E. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.
- F. BICSI TDMM - Telecommunications Distribution Methods Manual, 14th Edition; 2020.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- H. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. TIA-568.0 - Generic Telecommunications Cabling for Customer Premises; 2020e.
- L. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).
- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- O. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- P. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- Q. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, TIA-569, BICSI ITSIMM, BICSI TDMM, manufacturers' instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless

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steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

- D. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or inside-plant flexible nonmetallic communications raceway/innerduct.
- E. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70 and TIA-569.
- B. Provide conduit, fittings, supports, and accessories required for complete communications pathway.
- C. Provide products listed, classified, and labeled as suitable for purpose intended.
- D. Maximum Number of Communications Outlet Boxes per Continuous Conduit Homerun: Three.
- E. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Continuous Conduit Homerun Serving Three Communications Outlet Boxes: 1-1/4-inch (35 mm) trade size.
- F. Where conduit size is not indicated, size to comply with NFPA 70, TIA-569, and BICSI TDMM, but not less than applicable minimum size requirements specified. Where specified standards differ, comply with most stringent.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
 - 4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
 - 4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

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2.05 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 - 4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.06 ACCESSORIES

- A. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- B. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).
- C. Foam Conduit Sealant:
 - 1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
 - 2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 - 3. Rated to hold minimum of 10 ft (3.0 m) water head pressure.
- D. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
- E. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.
- C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.
- D. Galvanized Steel Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.
- E. Galvanized Steel Electrical Metallic Tubing (EMT): Install in accordance with NECA 101.
- F. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. Conceal conduits unless specifically indicated to be exposed.
 - 3. Arrange conduit to provide no more than equivalent of two 90-degree bend(s) between pull points.
 - 4. Arrange conduit to provide minimum bend radii in accordance with BICSI TDMM.
- G. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction.

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2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- H. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 5. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect cables.
 6. Secure joints and connections to provide mechanical strength and electrical continuity.
- I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves and/or slots for penetrations as indicated or as required to facilitate installation.
 4. Conceal bends for conduit risers emerging above ground.
 5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
 7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.
- J. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed cables or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where conduits are subject to earth movement by settlement or frost.
- K. Provide grounding and bonding.

3.03 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.04 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of cables.

END OF SECTION

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SECTION 271000

STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Communications system design requirements.
- B. Communications pathways.
- C. Copper cable and terminations.
- D. Communications equipment room fittings.
- E. Communications outlets.
- F. Communications grounding and bonding.
- G. Communications identification.

1.02 RELATED REQUIREMENTS

- A. Section 260533.16 - Boxes for Electrical Systems.
- B. Section 270533.13 - Conduit for Communications Systems.

1.03 REFERENCE STANDARDS

- A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.
- B. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; 2005e.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2024.
- E. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2018d, with Addenda (2020).
- F. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).
- G. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.
- H. TIA-607 - Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2024e.
- I. UL 444 - Communications Cables; Current Edition, Including All Revisions.
- J. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.
- K. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
 - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
 - 3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Arrange for Communications Service Provider to provide service.

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1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
- D. Evidence of qualifications for installer.
- E. Field Test Reports.
- F. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
 - 1. Record actual locations of outlet boxes and distribution frames.
 - 2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
 - 3. Identify distribution frames and equipment rooms by room number on drawings.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.
- B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
 - 1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
 - 2. Supervisors and installers factory certified by manufacturers of products to be installed.
- C. Products: Listed, classified, and labeled as suitable for the purpose intended.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

- A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
 - 1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
 - 2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
 - 3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F (0 to 60 degrees C) at relative humidity of 0 to 95 percent, noncondensing.
 - 4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
- B. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
 - 1. Locate main distribution frame as indicated on the drawings.
 - 2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.

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- C. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 PATHWAYS

- A. Conduit: See section 270533.13.

2.03 COPPER CABLE AND TERMINATIONS

- A. Manufacturers:
 - 1. Belden: www.belden.com/#sle.
 - 2. CommScope: www.commscope.com/#sle.
 - 3. General Cable Technologies Corporation: www.generalcable.com/#sle.
- B. Copper Horizontal Cable:
 - 1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
 - 2. Cable Type - Voice and Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
 - 3. Cable Capacity: 4-pair.
 - 4. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
 - 5. Cable Jacket Color - Voice and Data Cable: Blue.
- C. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.
- D. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
 - 1. Performance: 500 mating cycles.
 - 2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.
- E. Copper Patch Cords:
 - 1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.

2.04 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

- A. Backboards: Interior grade plywood without voids, 3/4 inch (19 mm) thick; UL-labeled fire-retardant.
 - 1. Size: As indicated on drawings.
 - 2. Do not paint over UL label.
- B. Equipment Frames, Racks and Cabinets:
 - 1. Component Racks: EIA/ECA-310 standard 19 inch (482.6 mm) wide.
 - 2. Wall Mounted Racks: Steel construction, hinged to allow access to back of installed components.
- C. Cable Management:
 - 1. Manufacturers:
 - a. Belden: www.belden.com/#sle.
 - b. CommScope: www.commscope.com/#sle.
 - c. Siemon Company: www.siemon.com/#sle.

2.05 COMMUNICATIONS OUTLETS

- A. Outlet Boxes: Comply with Section 260533.16.
 - 1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
 - 2. Minimum Size, Unless Otherwise Indicated:

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- a. Voice Only Outlets: 4 inch by 2 inch by 2-1/8 inch deep (100 by 50 by 54 mm) trade size.
- B. Wall Plates:
 - 1. Comply with system design standards and UL 514C.
 - 2. Accepts modular jacks/inserts.
 - 3. Capacity:
 - a. Voice Only Outlets: 2 ports.
 - b. Data or Combination Voice/Data Outlets: 4 ports.
 - 4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified _____.

2.06 GROUNDING AND BONDING COMPONENTS

- A. Comply with TIA-607.

2.07 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606.

2.08 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Factory test cables according to TIA-568 (SET).

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.
- B. Comply with Communication Service Provider requirements.
- C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

3.02 INSTALLATION OF PATHWAYS

- A. Install pathways with the following minimum clearances:
 - 1. 48 inches (1220 mm) from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
 - 2. 12 inches (300 mm) from power conduits and cables and panelboards.
 - 3. 5 inches (125 mm) from fluorescent and high frequency lighting fixtures.
 - 4. 6 inches (150 mm) from flues, hot water pipes, and steam pipes.
- B. Outlet Boxes:
 - 1. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of telecommunications outlets provided under this section.
 - a. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - b. Locate outlet boxes so that wall plate does not span different building finishes.
 - c. Locate outlet boxes so that wall plate does not cross masonry joints.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

- A. Cabling:
 - 1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
 - 2. Do not over-cinch or crush cables.
 - 3. Do not exceed manufacturer's recommended cable pull tension.
 - 4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
- B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:

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1. At Distribution Frames: 120 inches (3000 mm).
2. At Outlets - Copper: 12 inches (305 mm).
- C. Copper Cabling:
 1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch (12 mm) from point of termination.
 2. For 4-pair cables in conduit, do not exceed 25 pounds (110 N) pull tension.
 3. Use T568B wiring configuration.
- D. Wall-Mounted Racks and Enclosures:
 1. Install to plywood backboards only, unless otherwise indicated.
 2. Mount so height of topmost panel does not exceed 78 inches (1980 mm) above floor.
- E. Identification:
 1. Use wire and cable markers to identify cables at each end.
 2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
 3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Comply with inspection and testing requirements of specified installation standards.
- C. Visual Inspection:
 1. Inspect cable jackets for certification markings.
 2. Inspect cable terminations for color coded labels of proper type.
 3. Inspect outlet plates and patch panels for complete labels.
- D. Testing - Copper Cabling and Associated Equipment:
- E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

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SECTION 284600

FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Circuits from protected premises to supervising station, including conduit.
- D. Maintenance of fire alarm system under contract for specified warranty period.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Proposal Documents: Submit the following with cost/time proposal:
 - 1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
 - 3. Certification by Contractor that the system design will comply with Contract Documents.
 - 4. Proposed maintenance contract.
- C. Drawings must be prepared using AutoCAD Release ____.
- D. Evidence of designer qualifications.
- E. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
 - 1. Copy (if any) of list of data required by authority having jurisdiction.
 - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
 - 4. System zone boundaries and interfaces to fire safety systems.
 - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
 - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 - 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.

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10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
 11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
 12. Certification by Contractor that the system design complies with Contract Documents.
- F. Evidence of installer qualifications.
- G. Evidence of instructor qualifications; training lesson plan outline.
- H. Evidence of maintenance contractor qualifications, if different from installer.
- I. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
 2. Submit documentation of satisfactory inspections and tests.
 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- J. Operating and Maintenance Data: See Section 017800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 4. List of recommended spare parts, tools, and instruments for testing.
 5. Replacement parts list with current prices, and source of supply.
 6. Detailed troubleshooting guide and large scale input/output matrix.
 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- K. Project Record Documents: See Section 017800 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- L. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
 3. Maintenance contract.
- M. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.

1.04 QUALITY ASSURANCE

- A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

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- B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
 - 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 - 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 - 3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
 - 4. Certified in the State in which the Project is located as fire alarm installer.
- C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
- D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.05 WARRANTY

- A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
 - 1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
 - 2. Protected Premises: Entire building shown on drawings.
 - 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. ADA Standards.
 - b. The requirements of the local authority having jurisdiction .
 - c. Applicable local codes.
 - d. Contract Documents (drawings and specifications).
 - e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
 - 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
 - 5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
 - 6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
 - 7. Program notification zones and voice messages as directed by Owner.
 - 8. Fire Command Center: Located in on-premises supervising station.
 - 9. Fire Alarm Control Unit: New, located at supervising station.
 - 10. Combined Systems: Do not combine fire alarm system with other non-fire systems.
- B. Supervising Stations and Fire Department Connections:
 - 1. Public Fire Department Notification: By remote supervising station.
- C. Circuits:
 - 1. Initiating Device Circuits (IDC): Class B, Style A.
 - 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.

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3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Power Sources:

1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

2.02 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:

1. Sprinkler water control valves.
2. Dry-pipe sprinkler system pressure.
3. Dry-pipe sprinkler valve room low temperature.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

1. Sprinkler water flow.

2.03 COMPONENTS

A. General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Master Control Unit: As specified for Basis of Design above, or equivalent.

D. Initiating Devices:

1. Addressable Systems:
 - a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
 - b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

E. Notification Appliances:

F. Circuit Conductors: Copper or optical fiber; provide 200 feet (60 m) extra; color code and label.

G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

H. Locks and Keys: Deliver keys to Owner.

I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.

1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.

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3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
 - 1. Hands-On Instruction: On-site, using operational system.
 - 2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
- B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
 - 1. Initial Training: 1 session pre-closeout.
- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
 - 1. Initial Training: 1 session pre-closeout.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 - 1. Be prepared to conduct any of the required tests.
 - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
 - 5. Repeat demonstration until successful.
- B. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
 - 1. Approved operating and maintenance data has been delivered.
 - 2. Spare parts, extra materials, and tools have been delivered.
 - 3. All aspects of operation have been demonstrated to Owner.
 - 4. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
 - 5. Specified pre-closeout instruction is complete.

3.05 MAINTENANCE

- A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

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- B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.
- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
 - 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 - 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
 - 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- D. Provide trouble call-back service upon notification by Owner:
 - 1. Provide on-site response within 2 hours of notification.
 - 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 - 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- G. Comply with Owner's requirements for access to facility and security.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Removal of existing trees and vegetation
- B. Clearing vegetation, debris, trash and other materials within limits indicated
- C. Grubbing of vegetation within limits indicated
- D. Stripping of topsoil within limits indicated
- E. Removing above-grade site improvements within limits indicated
- F. Disconnecting, capping or sealing, and abandoning site utilities in place
- G. Disconnecting, capping or sealing, and removing site utilities
- H. Disposing of objectionable material

1.02 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving
- B. Section 32 12 16, Asphalt Paving
- C. Section 32 13 13, Concrete Pavement

1.03 RELATED DOCUMENTS

- A. ANSI A300: Industry Standards for Tree Care Practices
- B. Applicable Publications
 - 1. "Trees and Building Sites," official publication of the International Society of Arboriculture.
 - 2. "Arboriculture," the care of trees and shrubs by Dr. Richard Harris.

1.04 DEFINITIONS

- A. ANSI: American National Standards Institute
- B. CAL-OSHA: California Occupational Safety and Health Administration
- C. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.05 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.06 QUALITY ASSURANCE

- A. Do not remove or prune trees without first securing a permit from the appropriate agency.
- B. Prune to the standards of the International Society of Arborists and to ANSI A300.

1.07 PROJECT CONDITIONS

- A. Except for materials indicated to be stockpiled or to remain the Owner's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by the Owner's Representative. Avoid damaging materials designated for salvage.
- C. Unidentified Materials;
 - 1. If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to the Owner's Representative.
 - 2. If necessary, the Owner's Representative will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

PART 2 - PRODUCTS**2.01 SOIL MATERIALS**

- A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to engineered fill defined in Section 31 20 00, Earth Moving.

PART 3 - EXECUTION**3.01 PREPARATION**

- A. Protect and maintain benchmarks and survey control points during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain during construction.

3.02 TREE REMOVAL

- A. Remove trees designated for removal prior to the construction of new improvements in the vicinity:

1. When demolishing trees indicated to be removed within areas for new pavement or hardscape, remove tree, stump to a depth of two (2) feet below finish grade, and all roots located in the top twelve (12) inches of soil. Remove wood chips created from grinding process down to remaining stump then refill void and re-compact to 80% relative compaction. Use import soil as indicated in specifications for this purpose. Import soil and compaction in future paved areas shall be in accordance with Section 32 12 16, Asphalt Paving and Section 32 13 13, Concrete Pavement.
 2. When demolishing trees indicated to be removed within new landscaped areas, removal shall be done in one of the following ways:
 - a. For trees located in accessible areas, remove tree and grind stump to four (4) inches below finish grade. Backfill the void and re-compact to 80% relative compaction. Use import soil as indicated in specifications for this purpose. Do not remove existing roots.
 - b. For trees located in inaccessible areas, cut stump flush with finish grade, and cover with 3 inches of bark mulch. Do not grind the stump and do not remove existing roots.
- B. Perform tree removal work in a safe and proper manner, adhering to CAL-OSHA tree work protection standards and ANSI A300 Standards.
- C. All trees to be demolished shall be removed in such a way as to not damage branches, trunks, or root systems of adjacent trees.

3.03 RESTORATION

- A. Restore damaged improvements to their original condition, as acceptable to the Owner's Representative.
- B. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, as directed by the Owner's Representative.
1. Employ a qualified arborist, licensed in jurisdiction where the Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the Owner's Representative.

3.04 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.
- B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner's Representative or others unless authorized in writing by the Owner's representative, and then only after arranging to provide temporary utility services according to requirements indicated.
- D. Coordinate utility interruptions with utility company affected.
- E. Do not proceed with utility interruptions without the permission of the Owner's Representative and utility company affected. Notify Owner's Representative and utility company affected two working days prior to utility interruptions.

- F. Excavate and remove underground utilities that are indicated to be removed.
- G. Fill abandoned piping with cement slurry.
- H. Securely close ends of abandoned piping with tight fitting plug or cement slurry minimum 6 inches thick.

3.05 CLEARING AND GRUBBING

- A. Areas to be graded shall be cleared of existing vegetation, rubbish, existing structures, and debris.
- B. Remove obstructions, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
- C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
- D. Use only hand methods for grubbing within drip line of remaining trees.

3.06 SITE STRIPPING

- A. Strippings and spoils shall be disposed at an off-site location, per geotechnical recommendations.
- B. Remove vegetation before stripping soil.
- C. Surface soils that contain organic matter should be stripped. In general, the depth of required stripping will be relatively shallow (i.e. less than 2 inches); deeper stripping and grubbing may be required to remove isolated concentrations of organic matter or roots.
- D. Remove trash, debris, weeds, roots, and other waste materials.
- E. Stockpile soil materials designated to remain on site at a location approved by the Owner's Representative at a location away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- F. Do not stockpile soil within drip line of remaining trees.

3.07 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

3.08 BACKFILL

- A. Place and compact material in excavations and depressions remaining after site clearing in accordance with Section 31 20 00, Earth Moving.

3.09 DISPOSAL

- A. Remove surplus soil material, unsuitable soil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner's property.

END OF SECTION

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SECTION 31 20 00**EARTH MOVING****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Excavation and/or embankment from existing ground to subgrade, including soil sterilant, for roadways, driveways, parking areas, building pads, walks, paths, or trails and any other site improvements called for on the Plans.

1.02 SECTION EXCLUDES

- A. Earthwork related to underground utility installation shall be performed in accordance with Sections 31 21 00, Utility Trenching and Backfill.

1.03 RELATED SECTIONS

- A. Section 31 10 00, Site Clearing
- B. Section 31 23 19, Dewatering
- C. Section 33 46 00, Subdrainage

1.04 RELATED DOCUMENTS

- A. ASTM
 - 1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 2. D1586, Method for Penetration Tests and Split-Barrel Sampling of Soils
 - 3. D2487, Classification of Soils for Engineering Purposes
 - 4. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 5. D4318. Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 6. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
 - 7. E548, Guide for General Criteria Used for Evaluating Laboratory Competence
- B. California Building Code, California Code of Regulations, Title 24, Part 2, Chapter 18, Soils and Foundations, and Chapter 33, Safeguards During Construction
- C. Caltrans Standard Specifications, 2015
 - 1. Section 17, General
 - 2. Section 19, Earthwork
- D. CAL/OSHA, Title 8.

1.05 DEFINITIONS

- A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.
- B. Excavation: Removal of material encountered above subgrade elevations.

1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans or authorized by the Geotechnical Engineer.
 2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.
- C. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.
- D. Structural Backfill: Soil materials approved by the Geotechnical Engineer and used to fill excavations resulting from removal of existing below grade facilities, including trees.
- E. Structural Fill: Soil materials approved by the Geotechnical Engineer and used to raise existing grades.
- F. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.
- G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.
- I. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.
- J. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project. The Geotechnical Engineer will determine if a soil material is unsuitable.
- K. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.
- L. Utilities: onsite underground pipes, conduits, ducts and cables.

1.06 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Samples:
1. If required by the Geotechnical Engineer, provide 20 pound samples, sealed in airtight containers, tagged with source locations and suppliers of each proposed soil material from on-site or borrow sources, 72 hours prior to use. Do not import materials to the Project without written approval of the Geotechnical Engineer.
 2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer.

- C. Classification according to ASTM D2487 of each onsite or borrow soil material proposed for fill and backfill.
 - 1. Laboratory compaction curve in conformance with ASTM D1557 for each onsite or borrow soil material proposed for fill and backfill.

1.07 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- B. Conform all work in accordance with Caltrans Standard Specification Section 17, General and Section 19, Earthwork.
- C. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.
- D. Perform excavation, filling, compaction and related earthwork under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of the Geotechnical Engineer, shall be removed and replaced at no cost to the Owner. Notify the Geotechnical Engineer at least 24 hours prior to commencement of earthwork and at least 48 hours prior to testing.
- E. The Geotechnical Engineer will perform observations and tests required to enable him to form an opinion of the acceptability of the Project earthwork. Correct earthwork that, in the opinion of the Geotechnical Engineer, does not meet the requirements of these Technical Specifications and the Geotechnical Report.
- F. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Technical Specifications and the Geotechnical Report. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces and shall replace portions that in the opinion of the Geotechnical Engineer have been displaced or are otherwise unsatisfactory due to the Contractor's operations.
- G. Finish subgrade tolerance at completion of grading:
 - 1. Building and paved areas: ± 0.05 feet
 - 2. Other areas: ± 0.10 feet

1.08 PROJECT CONDITIONS

- A. Promptly notify the Owner's Representative of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Owner's Representative verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless the Contractor has notified the Owner's Representative in writing of differing conditions prior to the Contractor starting work on affected items.
- B. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.

- C. Prevent erosion of freshly-graded areas during construction and until such time as permanent drainage and erosion control measures have been installed in accordance with Section 01 50 50, Erosion Control.
- D. Temporarily stock-pile fill material in an orderly and safe manner and in a location approved by the Owner's Representative.
- E. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: On-site soils are considered suitable for use as fill provided the materials are placed in accordance with Geotechnical Recommendations. Highly expansive soils shall not be used as select structural fill, or used as backfill for trenches located within hardscape areas.
- B. Imported fill soils, if required, should be predominantly granular in nature, and should be free of organics, debris, or rocks over 3 inches in size, and shall be approved by the Geotechnical Engineer before importing to the site. Imported non-expansive soils shall have a Plasticity Index less than 15 as determined by ASTM D4318, an R-value of at least 20, and fines content between 15 and 65 percent. Import fill shall be considered non-hazardous per Department of Toxic Substances Control guidelines (DTSC, 2017) and non-corrosive per Caltrans Corrosion Guidelines (Caltrans, 2015).

2.02 SOIL STERILANT

- A. Commercial chemical for weed control, registered by EPA. Provide granular, liquid or wettable powder form.

PART 3 - EXECUTION

3.01 GENERAL

- A. Perform work in accordance with Caltrans Standard Specification Section 19, Earthwork, as modified by the Contract Documents.
- B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.
- C. The use of explosives will not be permitted.
- D. Grading and earthwork operations shall be observed and tested by a representative of the Geotechnical Engineer for conformance with the project plans/specifications and the geotechnical recommendations. This work includes site preparation, selection of satisfactory materials, and placement and compaction of the subgrades and fills. Sufficient notification prior to commencement of earthwork is essential to make certain that the work will be properly observed.

3.02 CONTROL OF WATER AND DEWATERING

- A. Comply with Section 31 23 19, Dewatering, if dewatering is necessary.

- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.
- C. Dewater during backfilling operation so that groundwater is maintained a least 1 foot below level of compaction effort.
- D. Obtain the Geotechnical Engineer's approval for proposed control of water and dewatering methods.
- E. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.
- F. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.
- G. Maintain dewatering system in place until dewatering is no longer required.

3.03 WET WEATHER CONDITIONS

- A. Do not prepare subgrade, place or compact soil materials if subgrade or materials are above optimum moisture content.
- B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.04 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Geotechnical Engineer, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.05 TOPSOIL STRIPPING

- A. Remove topsoil in accordance with Section 31 10 00, Site Clearing.

3.06 EXCAVATION

- A. Excavate earth and rock to lines and grades shown on plans and to the neat dimensions indicated on the plans, required herein or as required to satisfactorily compact backfill.
- B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.
- C. Excavation through buried concrete and other unknown obstructions will require specialized techniques for demolition and removal.
- D. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.
- E. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

3.07 GRADING

- A. Uniformly grade the Project to the elevations shown on plans
- B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.
- C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.08 SUBGRADE PREPARATION

- A. Subgrade Preparation: Prior to backfilling depressions created by the removal of old foundations and utility lines, scarify the bottom of the excavation to an approximate depth of 8 inches and uniformly moisture condition the scarified surfaces to a moisture content that is at least 2 percent over optimum. Compact the scarified surfaces to a minimum of 90 percent relative compaction at above optimum moisture content.
- B. Over-excavate any remaining soft (pumping) areas down to firm soil and backfill the area.
- C. Subgrade shall be maintained in a moist, but not wet, condition by periodically sprinkling water prior to the placement of additional fill or installation of roads. Subgrade that has been permitted to dry out and loosen or develop desiccation cracking should be scarified, moisture conditioned, and re-compacted as recommended above.
- D. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.
- E. Prepare subgrades under the structural section of paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.
- F. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.
- G. Obtain the Geotechnical Engineer's approval of subgrades prior to placing pavement structural section.

3.09 KEYWAYS AND BENCHES

- A. Provide keyways as indicated for fill slopes steeper than 6 horizontal to 1 vertical. Extend keyway 5 feet minimum into competent, undisturbed soil or 3 feet minimum into competent, undisturbed rock as directed by the Geotechnical Engineer.
- B. Place subsurface drains in bottom of keyway in accordance with Section 33 46 00, Subdrainage.
- C. Bench subgrade as indicated above toe of fill.
- D. Place subsurface drains at benches every 20 vertical feet or as directed by the Geotechnical Engineer.

3.10 LOT FINISH GRADING

- A. Blade finish lots to lines and grades indicated.

3.11 FILL PLACEMENT AND COMPACTION

- A. Place fill in uniformly moisture conditioned and compacted lifts not exceeding 8 inches in loose thickness. Each lift should be thoroughly moisture conditioned and compacted to 90 percent before successive fill layers are placed.
- B. In order to achieve satisfactory compaction in the subgrade and fill soils, it may be necessary to adjust the soil moisture content at the time of soil compaction per geotechnical recommendations. This may require that water be added and thoroughly mixed into any soils which are too dry or that scarification and aeration be performed in any soils which are too wet.
- C. Obtain the Geotechnical Engineer's approval of surface to receive structural fill prior to placement of structural fill material.
- D. Place structural fill on prepared subgrade.
- E. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.
- F. Do not compact by ponding, flooding or jetting.
- G. Perform compaction using rollers, pneumatic or vibratory compactors or other equipment and mechanical methods approved by the Geotechnical Engineer.
- H. Compaction requirements (unless specified otherwise by the Geotechnical Engineer):
 - 1. Compact structural fills less than 5 feet thick to 90 percent compaction.
 - 2. Compact structural fill 5 feet thick or greater to 95 percent compaction.
 - 3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 5 feet beyond pavement edges unless specified otherwise by the Geotechnical Engineer.
 - 4. Compact the upper 6 inches of subgrade soils under walks, structures and areas to receive structural fill to 90 percent compaction.

3.12 SOIL STERILIZATION

- A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concrete pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.
- B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.
- C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

3.13 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

SECTION 31 21 00**UTILITY TRENCHING AND BACKFILL****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Excavation, bedding, and backfill for underground storm drain, sanitary sewer, and water piping, underground HVAC piping, electrical conduit, telephone conduit, gas piping, cable TV conduit, etc., and associated structures.
- B. Provide labor, material, equipment, and services necessary to complete the backfilling and compacting as necessary for this project. Section includes, but is not limited to:
 - 1. Select Backfill Material
 - 2. Aggregate Base
 - 3. Detectable Tape
 - 4. Trench Excavation
 - 5. Pipe Bedding
 - 6. Trench Backfill
 - 7. Trench Surfacing
- C. This section excludes drainage fill material and placement around subdrains. See Section 33 46 00 – Subdrainage.

1.02 RELATED SECTIONS

- A. Section 31 10 00 – Site Clearing
- B. Section 31 20 00 – Earthwork Moving
- C. Section 33 10 00 – Water System
- D. Section 33 30 00 – Sanitary Sewer System
- E. Section 33 41 00 – Storm Utility Drainage Piping
- F. Section 33 46 00 – Subdrainage

1.03 RELATED DOCUMENTS

- A. ASTM
 - 1. D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - 2. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Applications.
- B. California Administrative Code, Title 24, Part 2 - Basic Building Regulations, Chapter 24, Excavations, Foundations, and Retaining Walls.
- C. Caltrans Standard Specifications, 2023
 - 1. Section 19, Earthwork
 - 2. Section 26, Aggregate Bases
 - 3. Section 68, Subsurface Drains

4. Section 96, Geosynthetics

D. CAL/OSHA, Title 8

1.04 DEFINITIONS

A. AC: Asphalt Concrete

B. ASTM: American Society for Testing and Materials

C. Base: The layer placed between the subgrade and surface pavement in a paving system.

D. Bedding: Material from bottom of trench to bottom of pipe

E. CDF: Controlled Density Fill

F. DIP: Ductile Iron Pipe

G. Engineered Fill:

1. Soil or soil-rock material approved by the Owner and transported to the site by the Contractor in order to raise grades or to backfill excavations.
2. Contractor shall provide sufficient tests, and a written statement that all materials brought onto the project site comply with specification requirements.

H. Excavation: Consists of the removal of material encountered to subgrade elevations

I. Initial Backfill: Material from bottom of pipe to 12 inches above top of pipe

J. PCC: Portland Cement Concrete

K. RCP: Reinforced Concrete Pipe

L. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure ASTM D1557.

M. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of ½ the outside diameter measured from the top or bottom of the pipe.

N. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base.

O. Subsequent Backfill: Material from 12 inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.

P. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.

1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans or authorized by the Geotechnical Engineer.
2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions without authorization by the Geotechnical Engineer. Unauthorized excavation shall be without additional compensation.

- Q. Utility Structures:
1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
 2. Sanitary sewer manholes, vaults, etc.
 3. Water vaults, etc.

1.05 SUBMITTALS

- A. Follow submittal procedures outlined in Section 01 10 00 – Supplemental General Requirements.
- B. Test Reports: Submit the following report for import material directly to the Owner from the Contractor's testing services:
1. Compaction test reports for aggregate base.
- C. Samples:
1. If required by the Geotechnical Engineer, provide 20-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material. Do not import materials to Project without written approval of the Geotechnical Engineer and the Owner.
 2. Provide materials from same source throughout work. Change of source requires approval of the Geotechnical Engineer and the Owner.

1.06 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- B. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19, Earthwork.
- C. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.
- D. The Geotechnical Engineer will perform observations and tests required to enable him to form an opinion of the acceptability of the trench backfill. Correct the trench backfill that, in the opinion of the Geotechnical Engineer, does not meet the requirements of these Technical Specifications and the Geotechnical Report.
- E. Soil Testing:
1. Contractor to engage a geotechnical testing agency, to include compaction testing and for quality control testing during fill operations.
 2. Test results will be submitted to the Owner.

1.07 PROJECT CONDITIONS

- A. Promptly notify the Owner of surface or subsurface conditions differing from those disclosed in the Geotechnical Report. First notify the Owner verbally to permit verification and extent of condition and then in writing. No claim for conditions differing from those anticipated in the Contract Documents and disclosed in the Geotechnical Report will be allowed unless Contractor has notified the Owner in writing of differing conditions prior to contractor starting work on affected items.
- B. Barricade open excavations and post with warning lights.
1. Operate warning lights and barricades as required.

2. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout, and other hazards.
 3. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- C. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.
- D. Provide dust and noise control in conformance with Section 01 10 00 Supplemental General Requirements.
- E. Environmental Requirements:
1. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.
 2. Protect existing streams, ditches and storm drain inlets during work on this project.
- F. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.
- G. Transport all excess soils materials by legally approved methods to disposal areas.
1. Coordinate with the Engineer.
 2. Any additional fill requirements shall be the responsibility of the Contractor.

1.08 EXISTING UTILITIES

- A. Locate existing underground utilities in the areas of work. For utilities that are to remain in place, provide adequate means of protection during excavation operations.
1. Locating of existing underground utilities shall include but not be limited to pot-holing prior to the start of construction.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Owner and/or utility agency immediately for directions.
1. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation.
 2. Repair damaged utilities to the satisfaction of the agency with jurisdiction.
- C. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Import materials will be subject to approval of the Civil Engineer.
- B. For approval of imported fill material, notify the Owner at least 7 days in advance of intention to import material.

2.02 PIPE BEDDING AND INITIAL BACKFILL

- A. Class 2 Aggregate Base: In accordance with Section 26 of Caltrans Standard Specifications, ¾ inch maximum.

- B. Sand: In accordance with Section 19-3.02F of Caltrans Standard Specifications.

2.03 SELECT BACKFILL

- A. Select backfill material shall be gravel, free of clay or organic matter and shall conform to the following gradation:

Sieve Size	Percentage Passing
1 inch	100
¾ inch	90 – 100
No. 4	35 – 60
No. 200	2 - 9

- B. For gas pipe and fuel piping select backfill shall be clean, graded building sand conforming to the following gradation:

Sieve Size	Percentage Passing
No. 4	100
No. 200	0 -5

2.04 WARNING TAPE

- A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.
1. Warning Tape Color Codes
 - a. Red: Electric
 - b. Yellow: Gas, Oil; Dangerous Materials
 - c. Orange: Telephone and Other Communications
 - d. Blue: Water Systems
 - e. Green: Sewer Systems
 - f. White: Steam Systems
 - g. Gray: Compressed Air
 2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.
 3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.05 DETECTION WIRE FOR NON-METALLIC PIPING

- A. Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

2.06 SUBSEQUENT BACKFILL

- A. Conform to on-site or imported structural backfill in Section 31 20 00, Earth Moving.

2.07 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)

- A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8 inch top size. The 3/8 inch aggregate shall not comprise more than 30% of the total aggregate content.
- B. Cement: Conform to the standards as set forth in ASTM C150, Type II Cement.
- C. Fly Ash: Conform to the standards as set forth in ASTM C618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.
- D. Air Entraining Agent: Conform to the standards as set forth in ASTM C260.
- E. Aggregates need not meet the standards as set forth in ASTM C33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.
- F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.
- G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.
- H. Mix design shall meet the Geotechnical Engineer's approval.

2.08 CONCRETE STRUCTURE BEDDING AND BACKFILL

- A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill, or other material approved by the Geotechnical Engineer.
- B. Poured-in-Place Structures:
 - 1. Bedding: Bedding shall meet the approval of the Geotechnical Engineer. In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
 - 2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 20 00, Earth Moving.

2.09 GEOSYNTHETICS

- A. Filter Fabric:
 - 1. Filter Fabric: Section 96-1.02 of Caltrans Standard Specifications.
 - 2. Mirafi 140N, Mirafi Inc., or approved equal.

PART 3 - EXECUTION**3.01 GENERAL**

- A. Comply with the recommendations of the Geotechnical Engineer.
- B. Protect existing trees to remain. No grading is permitted under the drip line of protected trees.
- C. Excavations for appurtenant structures, such as, but not limited to, manholes, transition structures, junction structure, vaults, valve boxes, catch basins, thrust blocks, and boring pits, shall be deemed to be in the category of trench excavation.
- D. Unless otherwise indicated in the Plans, all excavation for pipelines shall be open cut.
- E. Prior to commencement of work, become thoroughly familiar with site conditions.
- F. In the event discrepancies are found, immediately notify the Owner in writing, indicating the nature and extent of differing conditions.
- G. Backfill excavations as promptly as work permits.
- H. Do not place engineered fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the Owner.
- I. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
- J. In excavations, use satisfactory excavated or borrow material.
- K. Under grassed areas, use satisfactory excavated or borrow material.

3.02 SITE PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, which are to remain, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the Owner.

3.03 EXISTING UTILITIES

- A. Identify the location of existing utilities.
 - 1. Prior to trenching, the Contractor shall excavate at locations specifically indicated on the Plans, if any, and where new lines cross other utilities of uncertain depth and determine the elevation of the utility in question to ensure that the new line will clear the potential obstruction.
 - 2. The Contractor shall contact Underground Service Alert (USA) at 1-800-227-2600 for assistance in locating existing utilities.
 - 3. If, after the excavation, a crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the Owner to clear the utility.
- B. Protect all existing utilities to remain in operation.

- C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at Contractor's risk.
- D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
 - 1. Use hand or light equipment for excavating immediately adjacent to known utilities or for excavations exposing a utility or buried structure.
 - 2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
 - 3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
 - 4. Report damage of utility line or subsurface structures immediately to the Owner.
- E. Backfill trenches resulting from utility removal in lifts of 8 inches maximum.

3.04 TRENCH EXCAVATION

- A. General
 - 1. Excavation shall include removal of all water and materials that interfere with construction. The Contractor shall remove any water which may be encountered in the trench by pumping or other methods during the pipe laying, bedding and backfill operations. Material shall be sufficiently dry to permit approved jointing.
 - 2. Excavation shall include the construction and maintenance of bridges required for vehicular and pedestrian traffic, support for adjoining utilities.
 - 3. The Contractor shall be responsible to safely direct vehicular and pedestrian traffic through or around his/her work area at all times.
 - 4. The Contractor shall relocate, reconstruct, replace or repair, at his/her own expense, all improvements which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor.
- B. Existing Paving and Concrete:
 - 1. Existing pavement over trench shall be sawcut, removed, and hauled away from the job. Existing pavement shall be neatly sawcut along the limits of excavations.
 - 2. Existing concrete over the trench shall be sawcut to a full depth in straight lines, at a minimum distance of 12 inches beyond the edge of the trench, either parallel to the curb or at right angles to the alignment of the sidewalk.
 - 3. Boards or other suitable material shall be placed under equipment outrigging to prevent damage to paved surfaces.
- C. Trench Width:
 - 1. The maximum allowable trench widths at the top of the all pipe materials outside diameter of barrel pipe plus 18 inches. shall be as follows:
 - a. The maximum trench width shall be inclusive of all shoring.
 - b. If the maximum trench width is exceeded, the State's representative may direct the Contractor to encase or cradle the pipe in concrete at no additional charge.
 - 2. For pipes 3 inch diameter and larger, the free working space on each side of the pipe barrel shall not be less than 6 inches.
- D. Excavation Width at Springline of Pipe:
 - 1. Up to a nominal pipe diameter of 24 inches: Minimum of twice the outside pipe diameter, or as otherwise allowed or required by the Geotechnical Engineer.
 - 2. Nominal pipe diameter of 30 inches through 36 inches: Minimum of the outside pipe diameter plus 2 feet, or as otherwise allowed or required by the Geotechnical Engineer.

3. Nominal pipe diameter of 42 inches through 60 inches: Minimum of the outside pipe diameter plus 3 feet, or as otherwise allowed or required by the Geotechnical Engineer.
- E. Open Trench:
1. The maximum length of open trench shall be 300 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench shall be left open at the end of the day.
 2. Provisions for trench crossings and free access shall be made at all street crossings, driveways, water gate valves, and fire hydrants.
 3. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.
 4. Excavation Depth for Bedding: Minimum of 6 inches below bottom of pipe or as otherwise allowed or required by the Geotechnical Engineer, except that bedding is not required for nominal pipe diameters of 2 inches or less.
 5. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.
 6. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
 7. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.
- F. Excavated Material:
1. All excavated material not required for backfill shall be immediately removed and properly disposed of in a legal manner by the Contractor.
 2. Material excavated in streets and roadways shall be laid alongside the trench no closer than 2 feet from the trench edge and kept trimmed to minimize inconvenience to public traffic.
 3. Provisions shall be made whereby all storm and wastewater can flow uninterrupted in gutters or drainage channels.

3.05 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner, submit details and calculations to the Owner. The Owner may forward the submittal to the Geotechnical Engineer, the Consulting Engineer and/or the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by the Owner.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.06 PIPE BEDDING

- A. Obtain approval of bedding material from the Geotechnical Engineer.
- B. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of bedding material will not be permitted.
- C. Stabilization of Trench Bottom: When the trench bottom is unstable due to wet or spongy foundation, trench bottom shall be stabilized with gravel or crushed rock. The State's inspector will determine the suitability of the trench bottom and the amount of gravel or crushed rock needed to stabilize a soft foundation. Soft material shall be removed and replaced with gravel or crushed rock as necessary.
- D. Placement of Bedding Material: The trench bottom shall be cleaned to remove all loose native material prior to placing select backfill material. Sufficient select backfill material shall be placed in trench and tamped to bring trench bottom up to grade of the bottom of pipe. The relative compaction of tamped material shall be not less than 90 percent. It is the intention of these requirements to provide uniform bearing under the full length of pipe to a minimum width of 60 percent of the external diameter.

3.07 BACKFILLING

- A. Initial Backfill:
 - 1. Obtain approval of backfill material from Geotechnical Engineer.
 - 2. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12 inches above the top of the pipe in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of initial backfill material will not be permitted.
- B. Pipe Detection: In trenches containing pressurized plastic pipes, tracer wire shall be placed directly above the pipe and shall be connected to all valves, existing exposed tracer wires, and other appurtenances as appropriate.
- C. Installation of Tracer Wire:
 - 1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
 - 2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
 - 3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.
 - 4. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.

- D. Installation of Warning Tape
 - 1. Install tape approximately 1 foot above and along the centerline of the pipe.
 - 2. Where tape is not continuous lap tape ends a minimum of 2 feet.
- E. Subsequent Backfill:
 - 1. Above the level of initial backfill, the trench shall be backfilled with non-expansive native material from trench excavation or with imported select backfill material (Contractor's option). Subsequent backfill shall be free of vegetable matter, stones or lumps exceeding 3 inches in greatest dimension, and other unsatisfactory material.
 - 2. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8 inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction, except that the upper 36 inches in areas subject to vehicular traffic shall be compacted to at least 95% relative compaction, unless specified otherwise on the Plans or by the Geotechnical Engineer. Compact by pneumatic tampers or other mechanical means approved by the Geotechnical Engineer. Jetting or ponding of subsequent backfill material will not be permitted.
- F. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures that may cause excessive pipe displacement or damage the pipe. Jetting of trench backfill is not permitted.
- G. Utility backfill shall be inspected and tested by the Geotechnical Engineer during placement. Cooperate with the Geotechnical Engineer and provide working space for such tests in operations. Backfill not compacted in accordance with these specifications shall be re-compacted or removed as necessary and replaced to meet the specified requirements, to the satisfaction of the Geotechnical Engineer and the Owner prior to proceeding with the Project.
- H. Compaction testing shall be in accordance with California Test Method ASTM D1556 or D1557.

3.08 CLEANUP

- A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Owner.

END OF SECTION

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SECTION 31 40 00

SHORING AND UNDERPINNING

PART 1 - GENERAL

1.01 DESCRIPTION

1. Section Includes:
2. Design of bracing, shoring, and underpinning.
3. Selection of construction sequence.
4. Temporary bracing of the structure or portions of the structure as required to prevent the structure from becoming unsafe during construction.
5. Temporary shoring of portions of the structure as required to prevent the structure from becoming unsafe during construction.
6. Temporary shoring of excavations.
7. Construction and removal of posts, timbers, lagging, braces, etc. required in connection with bracing, shoring, and underpinning the structure during construction.
8. Excavation, concrete placement and backfilling required in connection with underpinning foundations.
9. Shoring of slopes and retaining walls as required.

B. Related Sections:

1. Section 02 41 00 - Demolition.
2. Section 03 10 00 - Concrete Forming and Accessories
3. Section 03 20 00 - Concrete Reinforcing
4. Section 03 30 00 - Cast-In-Place Concrete

1.02 REFERENCES

- A. Requirements of the GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. California Code of Regulations. Title 24, 2022 edition, also known as California Building Code (CBC).

- C. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply):
 - 1. American Society of Testing and Materials (ASTM).
 - 2. American Concrete Institute's "Specifications for Structural Concrete for Buildings" (ACI 301).

1.03 DESIGN REQUIREMENTS

- A. General: The stability and integrity of the structure during construction shall be maintained at levels generally acceptable within the construction industry by the use of bracing, shoring, and underpinning. In no case shall the structure be allowed to become unsafe during construction as defined by the local governing jurisdiction. Design stresses in bracing, shoring, and underpinning shall not exceed the allowable stresses.
- B. Bracing and Shoring for Structures:
 - 1. The bracing and shoring systems required to provide temporary support of a structure or portions of a structure during construction shall be designed to support the dead, live, soil, earthquake and wind loads that may be imposed on the structure during construction in accordance with industry standards and generally accepted engineering principles.
 - 2. The proposed bracing and shoring systems shall have foundations designed for allowable soil bearing pressures in accordance with the geotechnical investigation prepared for the Project.
- C. Shoring of Excavations and Underpinning: The proposed shoring and underpinning systems shall be designed for earth pressures and allowable soil bearing values as applicable in accordance with the geotechnical investigation prepared for the Project.

1.04 QUALITY ASSURANCE

- A. Design calculations and Shop Drawings of proposed bracing, shoring, and underpinning of the structure shall be prepared, stamped, and signed by a Structural Engineer registered in the State of California.
- B. The installation of all underpinning shall be observed by the Owner's Soils Engineer.
- C. All underpinning, bracing, and shoring systems shall be designed in accordance with applicable local codes.
- D. Inspection and testing of formwork, cast-in-place concrete, and concrete reinforcements required herein shall be similar to that called out in Sections 03 10 00, Concrete Forming and Accessories, 03 20 00, Concrete Reinforcing and 03 30 00, Cast-In-Place Concrete.

1.05 SUBMITTALS

- A. Submit under provisions of Division 01 Section "General Requirements."
- B. Submit to Architect for review the information on methods, sequences, drawings, and calculations for accomplishing this work. Employ a Structural Engineer registered in the State of California to provide such. Obtain approval from building official before proceeding. Contractor's Structural Engineer shall sign drawings and calculations and will be the Engineer of Record for that portion of the Work which he designs.
- C. Shop Drawings indicating layout, member sizes, connection details and construction sequence for bracing, shoring and underpinning. No work related to bracing, shoring or underpinning shall take place until the University has reviewed the Shop Drawings.
- D. Design calculations of bracing, shoring and underpinning showing member stresses and connections due to imposed loads.
- E. The Contractor shall be solely responsible for the design, adequacy, and satisfactory performance of the methods and means employed.

PART 2 - PRODUCTS**2.01 MATERIALS FOR SHORING AND BRACING**

- A. Materials for shoring and bracing shall be undamaged, high quality materials.

2.02 CONCRETE FOR UNDERPINNING

- A. Concrete for underpinning shall meet the requirements of Division 03 Section "Cast-in-Place Concrete".

PART 3 - EXECUTION**3.01 CONSTRUCTION**

- A. Construction of bracing, shoring and underpinning shall be in accordance with the reviewed Shop Drawings prepared by the Contractor's Engineer.
- B. Excavations for underpinning the foundations shall be inspected by the Geotechnical Engineer prior to placement of concrete.
- C. The Engineer responsible for design of bracing, shoring, and underpinning shall write a letter to the Architect certifying that construction of bracing, shoring, and underpinning was completed in accordance with the bracing, shoring, and underpinning Shop Drawings and meets its approval, prior to placement of concrete, sawcutting, and removal or modification of portions of the structure.
- D. Remove surplus excavated materials from site.

3.02 REMOVAL OF BRACING AND SHORING

- A. Bracing and shoring shall not be removed until the new members have acquired sufficient strength to support their weight and the loads superimposed thereon safely. In no case may bracing or shoring be removed until the time and sequence has been approved by the Engineer responsible for bracing and shoring and reviewed by the Inspector.
- B. In general, bracing and shoring of concrete shall remain in place for at least ten days, when they may be removed provided the concrete reached at least 80% of it's design strength and is sufficiently hard and will not be injured.

END OF SECTION

SECTION 32 11 00**PAVEMENT BASE COURSE****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Aggregate base

1.02 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving

1.03 RELATED DOCUMENTS

- A. ASTM:
 - 1. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 2. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
 - 3. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
 - 4. E548, Guide for General Criteria Used for Evaluating Laboratory Competence
- B. Caltrans Standard Specifications, 2023
 - 1. Section 26, Aggregate Bases

1.04 DEFINITIONS

- A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.
- B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.
- C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials. Perform work in accordance with Section 31 20 00, Earth Moving.

1.05 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.06 QUALITY ASSURANCE

- A. Conform all work and materials to the recommendations or requirements of the Geotechnical Report and meet the approval of the Geotechnical Engineer.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D1557.
- C. Perform installation of base materials under the observation of the Geotechnical Engineer. Materials placed without approval of the Geotechnical Engineer will be presumed to be defective and, at the discretion of the Geotechnical Engineer, shall be removed and replaced at no cost to the Owner. Notify the Geotechnical Engineer at least 24 hours prior to commencement of base material installation and at least 48 hours prior to testing.
- D. Do not mix or place cement treated base when the temperature is below 36 degrees F or when the ground is frozen.
- E. Do not project the finish surface of aggregate subbase above the design subgrade.
- F. Finish grade tolerance at completion of base installation: +0.05 feet

1.07 PROJECT CONDITIONS

- A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- B. Temporarily stockpile material in an orderly and safe manner and in a location approved by the Owner.
- C. Provide dust and noise control in accordance with Section 01 10 00, Supplemental General Requirements.

PART 2 - PRODUCTS**2.01 AGGREGATE BASE**

- A. Class 2 or 3, 1 ½ inch maximum or ¾ inch maximum in accordance with Caltrans Standard Specification Section 26, Aggregate Bases.

PART 3 - EXECUTION**3.01 GENERAL**

- A. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.

3.02 WET WEATHER CONDITIONS

- A. Do not place or compact subgrade if above optimum moisture content.
- B. If the Geotechnical Engineer allows work to continue during wet weather conditions, conform to supplemental recommendations provided by the Geotechnical Engineer.

3.03 AGGREGATE BASE

- A. Watering, Spreading and Compacting: In accordance with Caltrans Standard Specification Section 26-1.03D, Spreading and 26-1.03E, Compacting.

3.04 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to the Owner.

END OF SECTION

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SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Hot Mix Asphalt
- B. Tack coat
- C. Hot Mix Asphalt paving
- D. Hot Mix Asphalt overlay
- E. Speed bumps
- F. Asphalt curbs
- G. Pavement grinding
- H. Adjusting manholes, valves, monument covers and other structures to grade

1.02 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving
- B. Section 32 11 00, Pavement Base Course

1.03 RELATED DOCUMENTS

- A. ASTM
 - 1. D979: Standard Practice for Sampling Bituminous Paving Mixtures
 - 2. D1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
 - 3. D2041: Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
 - 4. D2726: Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
 - 5. D2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
 - 6. D3549: Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
- B. Caltrans Standard Specifications, 2023
 - 1. Section 20: Landscape
 - 2. Section 39: Asphalt Concrete
 - 3. Section 88: Engineering Fabrics
 - 4. Section 92: Asphalt Binder
 - 5. Section 94: Asphaltic Emulsions
 - 6. Section 96: Geosynthetics

1.04 DEFINITIONS

- A. ASTM: American Society for Testing Materials.
- B. Caltrans: State of California, Department of Transportation

1.05 QUALITY ASSURANCE

- A. Thickness of hot mix asphalt: In-place compacted thickness of asphalt courses will be determined according to ASTM D3549.
- B. Surface Smoothness: Finished surface of each asphalt course will be tested for compliance with smoothness tolerances.
- C. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D979.
 - 1. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement may be determined by testing core samples according to ASTM D1188 or ASTM D2726.
 - a. One core sample may be taken for every 1000 square yard or less of installed pavement, but in no case will fewer than 3 cores be taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

1.06 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Job-Mix Designs: Certificates signed by manufacturers certifying that each hot mix asphalt mix complies with requirements.
- C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Tack Coat: Minimum surface temperature of 60 F at application.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 F and rising at application.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 F at application.
 - 4. Reinforcing Fabric: Air temperature is 50 F and rising and pavement temperature is 40 F and rising.

PART 2 - PRODUCTS**2.01 HOT MIX ASPHALT**

- A. Type A In accordance with Caltrans Standard Specifications Section 39-2, Hot Mix Asphalt.
- B. Hot Mix Asphalt Materials:

1. Asphalt Binder: Grade PG 64-10 in accordance with Caltrans Standard Specification Section 92, Asphalt Binders.
 2. Tack Coat: Grade SS1 in accordance with Caltrans Standard Specification Section 94, Asphaltic Emulsions.
- C. Aggregates: 1 inch max gradation for virgin aggregate and recycled asphalt pavement (RAP) in accordance with to Caltrans Standard Specification Section 39-2.02, Type A Hot Mix Asphalt.
- D. Geosynthetic Pavement Interlayer: Paving Fabric in accordance with Caltrans Standard Specification Section 96, Geosynthetics.
- E. Soil Sterilant: In accordance with Caltrans Standard Specifications Section 20-5.03, Inert Ground Covers and Mulches.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. If necessary, perform subgrade preparation or remediation in accordance with Section 31 20 00, Earth Moving.
- D. Notify Owner in writing of any unsatisfactory conditions. Do not begin paving until these conditions have been satisfactorily corrected.

3.02 PAVEMENT GRINDING

- A. Clean existing paving surface of loose or deleterious material immediately before pavement grinding.
- B. Grind conforms as indicated.

3.03 SOIL STERILANT

- A. Furnish and apply to areas per manufacturer's specifications.

3.04 SURFACE PREPARATION FOR AGGREGATE BASE MATERIALS

- A. General: Immediately before placing asphalt materials remove loose and deleterious material from substrate surfaces and ensure that prepared subgrade is ready to receive paving in accordance with Caltrans Standard Specification Section 39-2.01C(3)(b) and in accordance with Section 32 11 00, Pavement Base Course.
- B. Tack Coat: Apply uniformly and at specified rates between HMA layers, to vertical surfaces of curbs, gutters and construction joints, and to existing pavement, including planed surfaces, in accordance with Caltrans Standard Specification Section 39-2.01C(3)(f).
1. Allow tack coat to cure undisturbed before paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.05 SURFACE PREPARATION FOR PAVEMENT AT HOT MIX ASPHALT OVERLAYS

- A. Pavement Irregularities: Level with hot mix asphalt, Type A, ½ inch max aggregate.
- B. Pavement Cracks:
 - 1. Less than ¼ inch wide: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion.
 - 2. Wider than ¼ inch: Clean of all dirt by compressed air jet, spray and seal with RS-1 asphaltic emulsion and skin patch.
- C. Clean surface of all material, such as leaves, dirt, sand, gravel, water and vegetation prior to applying binder of paving asphalt to existing surface.

3.06 GEOSYNTHETIC PAVEMENT INTERLAYER

- A. Place geosynthetic pavement interlayer in accordance with Caltrans Standard Specification Section 39-2.01C(3)g.

3.07 HOT MIX ASPHALT SPREADING AND COMPACTING EQUIPMENT

- A. Provide spreading and compacting equipment in accordance with Caltrans Standard Specification Section 39-2.01C(2).

3.08 HOT MIX ASPHALT PLACEMENT

- A. Place, spread and compact hot mix asphalt to required grade, cross section, and thickness in accordance with Caltrans Standard Specification Sections 39-2.01C(2), 39-2.01C(3), and 39-2.01C(8).
- B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.09 JOINTS

- A. Construct joints to ensure continuous bond between adjoining paving sections in accordance with Caltrans Standard Specification Sections 39-2.01C(4)
 - 1. Construct joints free of depressions with same texture and smoothness as other sections of asphalt course.
 - 2. Clean contact surfaces and apply tack coat.
 - 3. Offset longitudinal joints in successive courses a minimum of 6 inches.
 - 4. Offset transverse joints in successive courses a minimum of 24 inches.
 - 5. Compact joints as soon as hot mix asphalt will bear roller weight without excessive displacement.

3.10 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact in accordance with Caltrans Standard Specification Sections 39-2.01C(2).
- B. Compaction Requirements: Average Density to be 92 percent of reference maximum theoretical density according to ASTM D2041, but not less than 90 percent nor greater than 96 percent.

- C. Finish Rolling: Finish roll paved surfaces to remove roller marks while asphalt is still warm.
- D. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.
- E. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh asphalt. Compact by rolling to specified density and surface smoothness.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 HOT MIX ASPHALT CURBS AND DIKES

- A. Construction: Place over compacted surfaces in accordance with Caltrans Standard Specification Section 39-2.01C(9). Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.
- B. Shape: Place hot mix asphalt to curb cross section indicated.

3.12 SPEED BUMPS

- A. Construct speed bumps over compacted pavement surfaces in accordance with Caltrans Standard Specification Section 39-2. Apply a light tack coat prior to construction, unless pavement surface is still tacky and free of dust.
- B. Place asphalt concrete by hand using a template/screed designed to result in speed bump cross-section indicated after compaction.
- C. Compact speed bumps with 8 ton static roller.

3.13 ADJUSTING MANHOLES, VALVES, MONUMENT COVERS AND OTHER STRUCTURES TO GRADE

- A. Remove pavement, using vertical cuts, as needed to remove frame and provide for concrete collar. Do not damage adjacent pavement.
 - 1. Circular Covers: Cut circle with radius 6 inches larger than cover and concentric with cover.
 - 2. Rectangular Covers: Cut rectangle 6 inches larger than cover on all sides.
- B. Install grade rings or blocking as needed to raise cover to finish grade.
- C. Pour concrete collar:
 - 1. Bottom of Collar: Top of existing collar or 6 inches below top of proposed collar, whichever is at a higher elevation.
 - 2. Top of Collar: Bottom of existing asphalt pavement.
 - 3. Apply tack coat to all exposed surfaces.
 - 4. Fill excavation with hot mix asphalt and, while still hot, compact flush with adjacent surface.

3.14 INSTALLATION TOLERANCES

- A. Hot Mix Asphalt Pavement:

1. Course thickness and surface smoothness shall be in accordance with Caltrans Standard Specification Section 39-2.01A(4)(i)(iii)
 2. Total Thickness: Not less than indicated.
- B. Trench Patch:
1. Compacted surface: Within 0.01 foot of adjacent pavement.
 2. Do not create ponding.
- C. Adjust Covers:
1. Compacted surface: Up to 0.01 foot higher, and no lower, than adjacent pavement.
 2. Do not create ponding.

END OF SECTION

SECTION 32 13 13**CONCRETE PAVEMENT****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Furnishing, placing, spreading, compacting and shaping portland cement concrete pavement with undoweled transverse weakened plane joints, for vehicular traffic.
- B. Form construction and use in placing portland cement concrete pavement.
- C. Joints for portland cement concrete pavement.
- D. Finishing portland cement concrete pavement.
- E. Curing and protecting portland cement concrete pavement.

1.02 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving
- B. Section 32 11 00, Pavement Base Course
- C. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.03 RELATED DOCUMENTS

- A. AASHTO Standard Specifications
 - 1. T132: Standard Method of Test for Tensile Strength of Hydraulic Cement Mortars
- B. ASTM Standards
 - 1. D36: Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
 - 2. A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - 3. A706: Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
 - 4. A775: Standard Specification for Epoxy Coated Steel Reinforcing Bars.
 - 5. A934: Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
 - 6. A996: Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
 - 7. C94: Standard Specification for Ready-Mixed Concrete
 - 8. C603: Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants
 - 9. C639: Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
 - 10. C661: Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
 - 11. C679: ASTM C679-15 Standard Test Method for Tack-Free Time of Elastomeric Sealants
 - 12. C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)

13. C793: Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
 14. C881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 15. D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
 16. D1640: Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings
 17. D2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
 18. D2835: Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements.
 19. D3963: Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
 20. D6690: Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
- C. Caltrans Standard Specifications, 2023
1. Section 10, General
 2. Section 40, Concrete Pavement
 3. Section 52, Reinforcement
 4. Section 95, Epoxy
- D. Caltrans Standard Plans:
1. Plan P1: Jointed Plan Concrete Pavement – New Construction
 2. Plan P10: Concrete Pavement Dowel Bar Details

1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing and Materials
- C. Caltrans: State of California, Department of Transportation

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.
- B. Installer Qualification: An experienced installer who has completed pavement work 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.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

1.06 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results or other circumstances warrant adjustments.

- C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements.
 - 1. Cementitious materials and aggregates
 - 2. Steel reinforcement and reinforcement accessories
 - 3. Admixtures
 - 4. Curing compound
 - 5. Applied finish material
 - 6. Bonding agent of adhesive
 - 7. Joint filler
 - 8. Joint Sealant
 - 9. Tie Bars
 - 10. Epoxy
 - 11. Backer Rods

PART 2 - PRODUCTS

2.01 PORTLAND CEMENT CONCRETE

- A. In accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.02 BASE MATERIAL

- A. In accordance with Section 32 11 00, Pavement Base Course.

2.03 TIE BARS

- A. Deformed reinforcing steel bars conforming to the requirements of ASTM Designation A615, Grade 40 or 60
- B. Epoxy-coat in accordance with Caltrans Standard Specification Section 52-2.02, Epoxy-Coated Reinforcement, except bars must comply with ASTM A706; ASTM A996; or ASTM A615, Grade 40 or 60.
- C. Do not bend tie bars.

2.04 EPOXY

- A. Bond tie bars to existing concrete with epoxy resin in accordance with Caltrans Standard Specification Section 95-1.02D, Epoxy Adhesive for Bonding Freshly Mixed Concrete to Hardened Concrete.

2.05 SILICONE JOINT SEALANT

- A. Furnish low modulus silicone joint sealant in a one-part silicone formulation. Do not use acid cure sealants. Compound to be compatible with the surface to which it is applied and conform to the following requirements:

Specification	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	45 psi max.
Flow at 77° ± 1°F	ASTM C639 ^a	Shall not flow from channel
Extrusion Rate at 77° ± 1°F	ASTM C603 ^b	75-250 g per min.
Specific Gravity	ASTM D792 Method A	1.01 to 1.51
Durometer Hardness, at 0°F, Shore A, cured 7 days at 77° ± 1°F	ASTM C661	10 to 25
Ozone and Ultraviolet Resistance, after 5000 hours	ASTM C793	No chalking, cracking or bond loss
Tack free at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM C679	Less than 75 minutes
Elongation, 7 day cure at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D412 (Die C)	500 percent min.
Set to Touch, at 77° ± 1°F and 45% to 55% Relative Humidity	ASTM D1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquets, air cured 7 days at 77° ± 1°F	AASHTO T132 ^c	50 psi min.
Movement Capability and Adhesion, 100% extension at 0°F after air cured 7 days at 77° ± 1°F, and followed by 7 days in water at 77° ± 1°F	ASTM C719 ^d	No adhesive or cohesive failure after 5 cycles

Notes:

- a. ASTM Designation: C639 Modified (15 percent slope channel A).
 - b. ASTM Designation: C603, through 1/8 inches opening at 50 psi.
 - c. Mold briquets in conformance with the requirements in AASHTO Designation: T132, sawed in half and bonded with a 1/16 inches maximum thickness of sealant and tested in conformance with the requirements in AASHTO Designation: T132. Briquets shall be dried to constant mass at 212 ± 10°F.
 - d. Movement Capability and Adhesion: Prepare 12 inch x 1 inch x 3 inch concrete blocks in conformance with the requirements in ASTM Designation: C719. A sawed face shall be used for bond surface. Seal 2 inch of block leaving 1/2 inches on each end of specimen unsealed. The depth of sealant shall be 3/8 inches and the width 1/2 inches.
- B. Formulate the silicon joint sealant to cure rapidly enough to prevent flow after application on grades of up to 15 percent.
- C. Furnish to the Owner's Representative a Certificate of Compliance. Accompany certificate with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. Provide the certificate and accompanying test report for each lot of silicone joint sealant prior to use on the project.

2.06 ASPHALT RUBBER JOINT SEALANT

- A. Conform to the requirements of ASTM Designation: D6690 as modified herein or to the following:
1. Provide a mixture of paving asphalt and ground rubber. Ground rubber to be vulcanized or a combination of vulcanized and de-vulcanized materials ground so that 100 percent will pass a No. 08 sieve and contain not less than 22 percent ground rubber, by mass. Modifiers may be used to facilitate blending.
 2. The Ring and Ball softening point shall be 135°F minimum, when tested in conformance with the requirements in ASTM D36.

3. Provide asphalt rubber sealant material capable of being melted and applied to cracks and joints at temperatures below 400°F.
- B. The penetration requirements of Section 4.2 of ASTM Designation: D6690 do not apply. The required penetration at 77°F, 5 oz, 5s, shall not exceed 120.
- C. The resilience requirements of Section 4.5 of ASTM Designation: D6690 do not apply. The required resilience, when tested at 77°F, shall have a minimum of 50 percent recovery.
- D. Accompany each lot of asphalt rubber joint sealant shipped to the job site, whether as specified herein or conforming to the requirements of ASTM Designation D6690, as modified herein, by a Certificate of Compliance, storage and heating instructions and precautionary instructions for use.
- E. Heat and place in conformance with the manufacturer's written instructions and the details shown on the Plans. Provide manufacturer's instructions to the Owner's Representative. Do not place when the pavement surface temperature is below 50 °F.

2.07 PREFORMED COMPRESSION JOINT SEALANT

- A. Material: ASTM Designation: D2628.
 1. Number of cells: 5 or 6.
 2. Lubricant Adhesive: ASTM Designation D2835.
 3. Install compression seals along with lubricant adhesive according to the manufacturer's recommendations. Submit manufacturer's recommendations to the Owner's Representative`.
- B. Accompany each lot of compression seal and lubricant adhesive by a Certificate of Compliance, storage instructions and precautionary instructions for use. Also submit the manufacturer's data sheet with installation instructions and recommended model or type of preformed compression seal for the joint size and depth as shown on the Plans. Show evidence that the selected seal is being compressed at level between 20 and 50 percent at all times for the joint width and depth shown on the Plans.

2.08 BACKER RODS

- A. Provide backer rods that have a diameter prior to placement at least 25 percent greater than the width of the saw cut after sawing and are expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond, adverse reaction occurs between the rod and sealant. In no case use a hot pour sealant that will melt the backer rod. Submit a manufacturer's data sheet verifying that the backer rod is compatible with the sealant to be used.

2.09 SLIP RESISTIVE AGGREGATE FINISH

- A. Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

PART 3 - EXECUTION**3.01 WATER SUPPLY**

- A. Provide water supply in accordance with Caltrans Standard Specification Section 10-6, Watering.

3.02 SUBGRADE

- A. Prepare subgrade in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

3.03 SOIL STERILANT

- A. Furnish and apply to areas indicated in accordance with Section 31 20 00, Earth Moving.

3.04 PLACING

- A. Prepare concrete in accordance with Caltrans Standard Specification Section 40-1.03F, Placing Concrete.

3.05 SPREADING COMPACTING AND SHAPING

- A. Conform to the following:
 1. Stationary Side Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Stationary Side-Form Construction.
 2. Slip Form Construction: In accordance with Caltrans Standard Specification Section 40-1.03F(4), Slip Form Construction.

3.06 INSTALLING TIE BARS

- A. Install at longitudinal contact joints, longitudinal weakened plane joints, and transverse contact joints as shown on the Plans. In no case, shall any consecutive width of new portland cement concrete pavement tied together with tie bars exceed 50 feet. In no case shall tie bars be used at a joint where portland cement concrete and asphalt concrete pavements abut.
- B. Tie bars shall be installed at longitudinal joints by one of the 3 following methods:
 1. Drilling and bonding in conformance with the details shown on the Plans. Provide a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C881, Type V. Grade 3 (Non-Sagging), Class shall be as follows:

<u>Temperature of Concrete</u>	<u>Required Class of Epoxy Resin</u>
Lower than 40° F	A
40° F through 60° F	B
Above 60° F	C

2. Provide, at least 7 days prior to start of work, a Certificate of compliance and a copy of the manufacturer's recommended installation procedure. The drilled holes shall be cleaned in accordance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during the curing and shall remain undisturbed until the epoxy has cured a minimum time as specified by the manufacturer. Tie bars that are improperly bonded, as determined by the Owner's Representative, will be rejected. If rejected, adjacent new holes shall be

- drilled, as directed by the Owner's Representative, and new tie bars shall be placed and securely bonded to the concrete. All work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.
3. Insert the tie bars into the plastic slip-formed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished to such an extent that there is no evidence on the surface of the completed pavement that there has been any insertion performed. Any loose tie bars shall be replaced by drilling and grouting into place with epoxy as described in method 1 above at the Contractor's expense.
 4. By using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance and installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.

3.07 JOINTS

- A. Construct joints in accordance with Caltrans Standard Specification Section 40-1.03B, Joints, except that tie bars shall be as specified under Part 1, Materials.
 1. Construction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B(2), Construction Joints.
 - a. Construct a construction joint at the end of each day's work, or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.
 - b. If sufficient concrete has not been mixed to form a slab to match the next contraction joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of any excess concrete shall be at the Contractor's expense. Any excess material shall become the property of the Contractor and shall be properly disposed of.
 - c. A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of tie bars.
 2. Contraction Joints: In accordance with Caltrans Standard Specification Section 40-1.03B (3), Contraction Joints, except that the insert method of forming joints in pavement shall not be used.

3.08 FINISHING

- A. Finish concrete in accordance with Caltrans Standard Specification Section 40-1.03H, Finishing.
- B. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:
 1. Uniformly spread 40 lb per 100 sq. ft. of dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
 2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.

3.09 CURING

- A. Cure concrete in accordance with Caltrans Standard Specification Section 40-1.03I, Curing.

3.10 SEALING JOINTS

- A. Liquid Joint Sealant Installation.
1. The joint sealant detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after sealant has been placed, completely remove the joint material and disposed of, and replace at the Contractor's expense. Recess sealant below the final finished surface as shown on the Plans.
 2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
 3. Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 2 inch on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means approved means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of $1/4 \pm 1/32$ inches and a minimum pressure of 90-psi.
 4. Install backer rod as shown on the Plans. Provide an expanded, closed-cell polyethylene foam backer rod that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Install backer rod when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 40°F or above. Install backer rod when the joints to be sealed have been properly patched, cleaned and dried. Do not use a method of placing backer rod that leave a residue or film on the joint walls.
 5. Immediately after placement of the backer rod, place the joint sealant in the clean, dry, prepared joints as shown on the Plans. Apply the joint sealant by a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Apply adequate pressure to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant recess the surface of the sealant as shown on the Plans.
 6. Any failure of the joint material in either adhesion or cohesion of the material will be cause for rejection of the joint. Conform the finished surface of joint sealant to the dimensions and allowable tolerances shown on the Plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the Plans shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements.
 7. After each joint is sealed, remove all surplus joint sealer on the pavement surface. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.
- B. Preformed Compression Joint Seal Installation
1. The compression seal alternative joint detail for transverse and longitudinal joints, as shown on the Plans, shall apply only to weakened plane joints. Construct weakened plane joints by the sawing method. Should grinding or grooving be required over or adjacent to any joint after the compression seal has been placed, completely remove

- the joint materials and disposed of, and replace at the Contractor's expense. Compression seal shall be recessed below the final finished surface as shown on the Plans.
2. At the Contractor's option, transverse weakened plane joints shall be either Type DSC or Type SSC as shown on the Plans. Longitudinal weakened plane joints shall be Type SSC only as shown on the Plans.
 3. Seven days after the concrete pavement placement and not more than 4 hours before placing preformed compression joint seals, clean the joint walls by the dry sand blast method and other means as necessary to completely remove from the joint all objectionable material such as soil, asphalt, curing compound, paint and rust. After cleaning the joint, remove all traces of sand, dust and loose material from and near the joint for a distance along the pavement surfaces of at least 50 mm on each side of the joint by the use of a vacuum device. Remove surface moisture at the joints by means of compressed air or moderate hot compressed air or other means. Do not use drying procedures that leave a residue or film on the joint wall. Sandblasting equipment shall have a maximum nozzle diameter size of $1/4 \pm 1/32$ inches and a minimum pressure of 90 psi.

3.11 PROTECTING CONCRETE PAVEMENT

- A. Protect pavement in accordance with Caltrans Standard Specification Section 40-1.03J Protecting Concrete Pavement.

END OF SECTION

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SECTION 32 13 18**CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Materials for portland cement concrete
- B. Aggregate and aggregate grading for portland cement concrete
- C. Water for portland cement concrete
- D. Admixtures for portland cement concrete
- E. Proportioning for portland cement concrete
- F. Mixing and transporting portland cement concrete
- G. Formwork for cast in place portland cement concrete
- H. Embedded materials for portland cement concrete
- I. Steel reinforcement for portland cement concrete
- J. Placing and finishing portland cement concrete
- K. Curing portland cement concrete
- L. Protecting portland cement concrete

1.02 RELATED SECTIONS

- A. Section 32 12 16, Asphalt Paving
- B. Section 32 13 13, Concrete Pavement

1.03 RELATED DOCUMENTS

- A. ASTM Standards
 - 1. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 2. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 3. C94, Standard Specification for Ready-mixed Concrete
 - 4. C150, Standard Specification for Portland Cement
 - 5. C260, Standard Specification for Air-Entraining Admixtures for Concrete
 - 6. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 - 7. C494, Standard Specification for Chemical Admixtures for Concrete.
 - 8. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Portland Cement

9. C1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
 10. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
 11. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- B. Caltrans Standard Specifications, 2023
1. Section 51: Concrete Structures
 2. Section 73: Concrete Curbs and Sidewalks
 3. Section 90: Concrete

1.04 DEFINITIONS

- A. ASTM: American Society for Testing and Materials

1.05 SUBMITTALS

- A. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Consulting Engineer. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the Plans. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.
- B. Reinforcing Steel Shop-Drawings

1.06 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.
1. Slump tests: Have available, at job site, equipment required to perform slump tests. Make one slump test for each cylinder sample, from same concrete batch. Allowable maximum slump shall be 4 inches for walls and 3 inches for slabs on grade and other work.
- B. Certifications:
1. Provide Owner's Representative at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials contained comply with the requirements of the Contract Documents in all respects.
 - b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
 - c. Statement of type and amount of any admixtures.
 2. Provide Owner's Representative, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.

1.07 DESIGNATION

- A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall be considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for

acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.

- B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS

2.01 PORTLAND CEMENT

- A. General: Type II or Type V cement conforming to the requirements of ASTM C150. Contractor may substitute pozzolan for portland cement in amounts up to 15% of the required mix unless high early strength concrete is specified. Pozzolan shall consist of Class F Fly Ash meeting the requirements of ASTM C618.
- B. Color: Provide a coloring equivalent to ¼ pound of lampblack per cubic yard. Add to the concrete at the central mixing plant.

2.02 AGGREGATE AND AGGREGATE GRADATION

- A. General: Fine and coarse aggregates shall be ¾ inch maximum size; clean and crushed aggregate free of materials which may cause staining. Aggregates shall conform to the requirements of section 90-1.02C of the Caltrans Standard Specifications.
- B. Aggregate Size and Gradation: Conform to the requirements of section 90-1.02C(4)(d) of the Caltrans Standard Specifications for 1 inch maximum combined aggregate.

2.03 WATER

- A. General: Water shall be clean, free from injurious amounts of oil, alkali, organic matter, or other deleterious material, and not detrimental to concrete per ASTM C94. Water shall conform to the requirements of section 90-1.02D of the Caltrans Standard Specifications, for mixing and curing portland cement concrete and for washing aggregates.

2.04 CHEMICAL ADMIXTURES

- A. Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material. Admixtures shall conform to the requirements of section 90-1.02E of the Caltrans Standard Specifications and as noted herein or on the Plans.
 - 1. Air-Entraining Admixture: ASTM C260/C260M
 - 2. Water-Reducing Admixture: ASTM C494/C494M, Type A
 - 3. Retarding Admixture: ASTM C494/C494M, Type B
 - 4. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D
 - 5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F
 - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G
 - 7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II

2.05 CLASSIFICATION OF PORTLAND CEMENT CONCRETE

- A. Unless specified otherwise herein or on the Plans, portland cement concrete for the following items shall be designated as follows:
1. Curbs, Gutters, and Sidewalks: Minor concrete.
 2. Cast in Place Concrete Pipe: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.
 3. Thrust Blocks: The concrete shall have a minimum compressive strength of 3,000 psi.
 4. Sign and Fence Footings: The concrete shall consist of a minimum of 376 pounds of portland cement per cubic yard of concrete.
 5. Water, Storm, and Sanitary Structures: The concrete shall consist of a minimum of 564 pounds of portland cement per cubic yard of concrete.

2.06 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless specified otherwise herein or on the Plans, expansion joint thickness shall be as follows:
1. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½ inch
 2. Structures: As indicated

2.07 REINFORCEMENT AND DOWELS

- A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM A615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.
- B. Slip dowels, where noted or called for on the Plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM A615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.
- C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM A1064. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.
- D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM A1064.
- E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.08 CURING AND SEALING MATERIALS

- A. Curing Compounds:
1. Concrete surface repellent-vertical and/or flatwork: Repello surface treatment, invisible chemical treatment barrier system.
 2. Curing and sealing-exterior: Colorcure concrete cureseal manufactured by L.M. Scofield Company or approved equal. Color-matched, water-based curing and sealing compound that complies with ASTM C309.

3. Color Conditioned Decorative Portland Cement Concrete: LITHOCHROME colorwax manufactured by L.M. Scofield Company or approved equal. Color-matched, water-based curing and sealing compound that complies with ASTM C309.

2.09 FORMS

- A. Conform to the requirements of Section 73-1.03C and Section 90-1.03B(5) of the Caltrans Standard Specifications.
- B. Tolerance: Not to deviate more than ¼ inch in 10 feet in grade and alignment.

2.10 PRECAST CONCRETE STRUCTURES

- A. Conform to the following Sections of Caltrans Standard Specifications:
 1. 51-7, Minor Structures
 2. 70-5.02, Flared End Sections

2.11 CONCRETE VEHICULAR PAVEMENT

- A. General: See Section 32 13 13, Concrete Pavement.

PART 3 - EXECUTION

3.01 STRUCTURAL EXCAVATION

- A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
- B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density as determined by ASTM D1557.
- C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site.

3.02 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by the Owner's Representative, submit details and calculations to the Owner's Representative. The Owner's Representative may forward the submittal to the Consulting Engineer for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by the Owner's Representative.

- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.03 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.04 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
 - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
 - 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
 - 1. Surfaces exposed to water: 4 inches.
 - 2. Surfaces poured against earth: 3 inches.
 - 3. Formed surfaces exposed to earth or weather: 2 inches.
 - 4. Slabs, walls, not exposed to weather or earth: 1 inch.
- D. Minimum spacing, center of parallel bars shall be two and one half (2 ½) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.05 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

- A. Transit mix concrete in accordance with the requirements of ASTM Designation C94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by the Owner's Representative.

- B. Do not hand mix concrete for use in concrete structures.

3.06 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner's Representative. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. Concrete in certain locations may be pumped into place upon prior approval by the Owner's Representative. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.07 PLACING ACCESSORY MATERIALS

- A. Place water stops and other items required to be embedded in of portland cement concrete structures at locations shown or required in accordance with Section 51-2.04 of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans.
- B. Curing Compounds:
 - 1. Regular Portland Cement Concrete: 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.
 - 2. Color Conditioned Decorative Portland Cement Concrete: Apply in accordance with the manufacturer's written instructions.

3.08 FORM REMOVAL

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.
- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.
- C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.
- D. Leave edge forms in place at least 24 hours after pouring.

3.09 FIELD QUALITY CONTROL

- A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.
- B. No concrete shall be placed prior to approval of forms.

- C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.
- D. Conform the finish grade and cross section of concrete improvements to the design grades and cross sections.
- E. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances ACI 117 and as follows:
 - 1. Elevation: $\frac{1}{4}$ inch.
 - 2. Thickness: Plus $\frac{3}{8}$ inch, minus $\frac{1}{4}$ inch.
 - 3. Surface: Gap below 10 foot long, unleveled straightedge not to exceed $\frac{1}{4}$ inch.
 - 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 - 5. Vertical Alignment of Tie Bars and Dowels: $\frac{1}{4}$ inch.
 - 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: $\frac{1}{2}$ inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel $\frac{1}{4}$ inch per 12 inches.
 - 8. Joint Spacing: 3 inches, unless otherwise indicated.
 - 9. Contraction Joint Depth: Plus $\frac{1}{4}$ inch, no minus.
 - 10. Joint Width: Plus $\frac{1}{8}$ inch, no minus.

3.10 RESTORATION OF EXISTING IMPROVEMENTS

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.
- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

SECTION 32 13 75**CONCRETE CURBS AND GUTTERS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Portland cement concrete curbs and gutters, sidewalk, curb ramps and driveways.

1.02 RELATED SECTIONS

- A. Section 31 20 00, Earth Moving
- B. Section 32 11 00, Pavement Base Course
- C. Section 32 13 13, Concrete Pavement
- D. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.03 RELATED DOCUMENTS

- A. American society for Testing and Materials (ASTM)
 - 1. A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - 2. D1751 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- B. Caltrans Standard Specifications, 2015
 - 1. Section 51: Concrete Structures
 - 2. Section 72: Slope Protection
 - 3. Section 73: Concrete Curbs and Sidewalks
 - 4. Section 90: Concrete

1.04 DEFINITIONS

- A. ASTM: American Society for Testing Materials
- B. ACI: American Concrete Institute

1.05 SUBMITTALS

- A. Submittal procedures shall be as outlined in Section 01 10 00 – Supplemental General Requirements.
- B. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by the Owner. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

1.06 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with Section 90 of the Caltrans Standard Specifications.
- B. Certifications:
 - 1. Provide Owner at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials contained comply with the requirements of the Contract Documents in all respects.
 - b. Proportions and mixing comply with the design mix approved by the Consulting Engineer. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
 - 2. Settlement of type and amount of any admixtures.
 - 3. Provide Owner, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.
- C. Conform to the applicable provisions of Sections 51, 73 and 90 of the Caltrans Standard Specification and these Technical Specifications.
 - 1. Conform construction of portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks) to the requirements of Section 73 of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
 - 2. Construct "V" ditches in accordance with Section 72-5 of the Caltrans Standard Specifications; except that finishing shall be in accordance with Standard Specification Section 73, or as otherwise required in these Technical Specifications or shown on the Plans.

1.07 DESIGNATION

- A. General: Whenever the 28 day compressive strength is designated herein or on the Plans is 3,600 psi or greater, the concrete shall be considered to be designated by compressive strength. The 28 day compressive strength shown herein or on the plans which are less than 3,600 psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-2 of the Caltrans Standard Specifications.
- B. Unless specified otherwise herein or on the Plans, portland cement concrete for curbs, gutters, sidewalks and their appurtenances such as island paving, curb ramps and driveways, shall be minor concrete as specified in Section 90-2 of the Caltrans Standard Specifications.

PART 2 - PRODUCTS**2.01 GENERAL**

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.02 PORTLAND CEMENT CONCRETE

- A. Unless specified otherwise herein or on the Plans, portland cement concrete for items in this section shall be Minor Concrete as specified in Section 90-2 of the Caltrans Standard Specifications.
- B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:
 - 1. Compressive Strength:
 - a. Typical: 3000 psi, minimum at 28 days, unless otherwise indicated.
 - b. Curbs & Gutters: 3500 psi, minimum at 28 days.
 - 2. Slump Limit: 8 inches minimum for concrete containing high-range water-reducing admixture (superplasticizer, limited to flatwork only); 4 inches for other concrete.
 - 3. Water/Cement Ratio: 0.5

2.03 CURBS AND GUTTERS FORMS

- A. Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.

2.04 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM Designation D1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.
- B. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
 - 1. Curbs, Curb Ramps, Island Paving, Driveways and Gutter Depressions: 1/4 inch

2.05 REINFORCEMENT AND DOWELS

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION**3.01 GENERAL**

- A. Comply with requirements of Section 32 13 18, Cement and Concrete for Exterior Improvements.
- B. Form, place and finish concrete curbs, gutters, walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.
- C. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12 inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6 inch deep lift of asphalt concrete after gutter form is removed.

3.02 SUBGRADE

- A. Conform to Section 73-1.03B of Caltrans Standard Specifications.

3.03 SOIL STERILANT

- A. Furnish and apply an oxidation granular preemergent soil sterilant to prepared subgrade or after installation of rock or aggregate base uniformly at the rate recommended by the manufacturer.

3.04 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to insure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.05 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
 - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
 - 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
 - 1. Surfaces exposed to water: 4 inches
 - 2. Surfaces poured against earth: 3 inches
 - 3. Formed surfaces exposed to earth or weather: 2 inches
 - 4. Slabs, walls, not exposed to weather or earth: 1 inch
- D. Minimum spacing, center of parallel bars shall be two and one half (2 ½) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.06 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by the Owner. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.
- E. Concrete in certain locations may be pumped into place upon prior approval by the Owner. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.07 EXPANSION JOINTS

- A. Construct expansion joints incorporating premolded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, median/island paving, valley gutters, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch smooth slip dowels in the positions shown or noted on the detail drawings.
- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

3.08 WEAKENED PLANE JOINTS

- A. Construct weakened plane joints in concrete curbs, gutters, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.
- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.
- C. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

3.09 FINISHING CONCRETE

- A. Finish curb and gutter in conformance with the applicable requirements of Section 73 of the Caltrans Standard Specifications as modified herein.
- B. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.
- C. Provide a broom finish to all horizontal surfaces perpendicular to the path of travel on surfaces used by pedestrians:

1. Sloped Less than 6%: Provide a medium salt (medium broom) finish by drawing a soft bristle broom across concrete surface, perpendicular to line of traffic, to provide a uniform fine line texture.
2. Surfaces Sloped Greater than 6%: Provide a slip resistant (heavy broom finish) by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.10 FORM REMOVAL

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.
- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.
- C. Leave edge forms in place at least 24 hours after pouring.

3.11 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

- A. New curb or gutter is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert ½ inch diameter by 12 inch long dowels at 24 inches on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.
- B. A cold joint to the existing curb is not acceptable.

3.12 FIELD QUALITY CONTROL

- A. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.
- B. Variation of concrete improvements from design grade and cross section as shown or called for on the plans shall not exceed the tolerances established in Section 73 of the Caltrans Standard Specifications.

3.13 RESTORATION OF EXISTING IMPROVEMENTS

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.
- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

SECTION 32 15 00**STABILIZED DECOMPOSED GRANITE PAVING****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Crushed aggregate blended with Granitecrete or approved equivalent admixture surfacing.

1.02 RELATED SECTIONS

- A. Midpeninsula Regional Open Space District General Conditions
- B. Section 01300, Supplemental General Requirements
- C. Section 01500, Erosion Control
- D. Section 02200, Earthwork
- E. Section 02760, Pavement Base Course

1.03 RELATED DOCUMENTS

- A. ASTM:
 - 1. C136 – Sieve Analysis of Fine and Coarse Aggregates
 - 2. D2419 – Sand Equivalent Value of Soils and Fine Aggregates
 - 3. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 4. D3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
 - 5. E329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
 - 6. E548, Guide for General Criteria Used for Evaluating Laboratory Competence
- B. Caltrans Standard Specifications, 2015
 - 1. Section 24, Stabilized Soils
 - 2. Section 25, Aggregate Subbases
 - 3. Section 26, Aggregate Bases
- C. RIS – Redwood Inspection Services Grades of California Redwood

1.04 DEFINITIONS

- A. Geotechnical Testing Agency: An independent testing agency qualified according to ASTM E329 to conduct soil materials and rock definition testing, as documented according to ASTM D3740 and ASTM E548.
- B. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ cubic yards or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D1586, exceeds a standard penetration resistance of 100 blows/2 inches.

- C. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below grade.
- D. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials. Perform work in accordance with Section 02200, Earthwork.

1.05 SUBMITTALS

- A. Mock-ups
 - 1. Construct mockup of two square feet minimum of crushed aggregate blended with GraniteCrete admixture surfacing or approved equivalent, including base course and edging, at location approved by Owner's Representative. Build mockup seven days prior to installation. Intent of the mockup is to demonstrate surface finish, texture, color and standard of workmanship.
 - 2. Notify Owner's Representative seven days in advance of mockup construction.
 - 3. Allow Owner's Representative to view and obtain approval of mock-up before proceeding with rest of crushed aggregate blended with admixture surfacing.
 - 4. Approved mock-up may remain as first in place construction.
- B. Manufacturer's product data sheet and installation instructions indicating that product complies with specifications for:
 - 1. Crushed aggregate blended with admixture surfacing
 - 2. Edging
- C. Decomposed Granite: A one-quart sample with supplier and source clearly indicated of decomposed granite to be used shall be submitted to the Engineer for approval.
- D. Decomposed Granite Stabilizing Admixture
- E. Trex Edging or approved equivalent.
- F. Product data cut sheets for any products furnished in this section.
- G. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.06 QUALITY ASSURANCE

- A. Professional Installation
 - 1. Installations 500 square feet and over up to 3,000 square feet – must be an admixture recommended installer at a minimum. Installations 3,000 square feet and over – must be an Approved Installer.
 - 2. An installer not approved, but with sufficient experience for the project as determined by the admixture manufacturer, may fulfill this requirement by providing a current letter from the admixture manufacturer verifying their ability to complete a successful installation for this specific project.
 - 3. For installations 3,000 square feet and over - if the installer is not approved as noted above, there shall be a mandatory Pre-Construction Meeting on site with the admixture company representative. The installers, foreman, and supervisor managing the installation are required to attend the meeting.
 - 4. A representative from the admixture company shall also observe the installation on-site until the company feels confident the installer will successfully install the product to their specifications and satisfaction.

5. The installation instructions in this Specification are meant as a guide for bidding purposes and will be superseded by the approved Submittal of installation instructions from the admixture company and any field direction provided by the company representative.
- B. Porous Base Rock Testing
1. Testing shall occur during installation at [] ton increments of shipping for sieve conformance. Results shall be submitted prior to completion of the stone base installation.
 - a. The stone field area shall have a permeable rate no less than 14" per hour. The testing shall be per Din 8035 Part 7, ASTM 2434 (constant head), or ASTM F2898 testing methods.
 - b. In addition to the lab testing, after installation of any aggregate base cross-section, designed to conduct rainfall to the sub-soils and/or under-drain system, the finished aggregate base shall be tested, in situ for infiltration rate, using method ASTM F2898. The test shall be performed by a registered Geotechnical Engineer or certified agronomist.
 2. The Contractor is responsible to meet this performance specification, before proceeding with installation, and shall bear the cost of the on-site testing and the cost of any additional work necessary to achieve compliance with the specification.
 3. All test results shall be logged and documented by the Owner's Technical Representative or Geotechnical Engineer. If at any time the processed stone base does not meet specifications, it shall be the Contractor's responsibility to restore, at his expense, the processed stone base to the required grade, cross-section and density.
 4. After the contractor has independently confirmed compliance with all the above tolerances, planarity and elevation verified by a licensed surveyor and compaction, gradation, & permeability verified by Geotechnical Engineer, he shall notify the appropriate party and schedule a final inspection for approval. The contractor shall make available an orbital laser system to the Inspection Team for the inspection process.
 5. The compaction rate for porous base rock should be 88%. The compaction rate for non-porous base rock should be 95%.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all admixture materials in original, unopened packaging. Protect materials and aggregate from contamination with foreign matter. Store under waterproof cover and protect from dampness.

1.08 PROJECT CONDITIONS

- A. Do not install crushed aggregate blended with admixture surfacing when sub-base is wet at saturated field capacity.
- B. Do not install admixture materials during rainy conditions or below 40 degrees Fahrenheit.

1.09 SEQUENCING

- A. Do not install work specified in this section prior to acceptance of earth moving. Coordinate work specified in this section with work specified in other sections to minimize cutting of - and operation of - heavy equipment over newly-installed surfacing.
- B. Contractor shall stake and layout all paving areas for review by the Owner's Representative prior to excavation.

- C. Submit in accordance with project submittal procedures.
 - 1. Construct mockup of two square feet minimum of crushed aggregate blended with admixture surfacing, including base course and edging, at location approved by Owner's Representative. Build mockup seven days prior to installation. Intent of the mockup is to demonstrate surface finish, texture, color and standard of workmanship.

PART 2 - PRODUCTS

2.01 CRUSHED AGGREGATE BLENDED WITH ADMIXTURE SURFACING MATERIALS

- A. Accepted Manufacturer:
 - 1. Specification is based on products by GraniteCrete, Inc.
 - 2. 419 Webster Street, Suite 202
 - 3. Monterey, CA 93940
 - 4. Phone: (800) 670-0849; Fax (800) 670-0849
 - 5. GraniteCrete admixture is an all-natural product and does not contain oils, polymers, resins or enzymes.
 - 6. Substitutions: Products by other manufacturers that comply with the project specifications and are approved equivalents are acceptable.
- B. Decomposed Granite (DG), crushed aggregate.
 - 1. DG shall have a 3/8" maximum gradation, produced from naturally friable rock/granite with enough fines to produce a smooth walking surface. Materials should be free from clay lumps, organic matter, and deleterious material. Blends of coarse sand and rock dust are not acceptable.
 - 2. Use a single supply source for the entire quantity required.
 - 3. Gradation, in accordance with ASTM C136.
 - 4. Color: Should have gold to yellow hues. To be selected by Owner's Representative from manufacturer's standard colors.
- C. Aggregate binder: Provide Granitecrete admixture or approved equivalent. Color: [Desert Sand] [Natural Gold]

2.02 BASE COURSE MATERIAL

- A. Material: Class 2 Permeable Base Rock in accordance with Caltrans Standard Specification Section 68 Subsurface Drains.

2.03 ACCESSORIES

- A. Water: Free from contaminants that would discolor or be deleterious to crushed aggregate blended with admixture surfacing.
- B. Edging
 - 1. Material: Trex header board or approved equivalent
 - 2. Stakes: Steel, 3/16" x 16" long x 1-3/4" wide at top tapering to point at bottom; located 36" o.c. maximum.
 - 3. Finish: Provide in color to be selected by Owner's Representative from manufacturer's standards.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine grading and subsoil conditions. Do not proceed until conditions are acceptable.

3.02 PREPARATION

- A. Excavation: Excavate to depth required so edges of crushed aggregate blended with admixture surfacing will match adjacent grades and have a maximum cross slope of 1.5 percent.
- B. Sub-grade Preparation: Comply with Caltrans Standard Specifications.
- C. Base Course Installation: Class II permeable base rock at 90% compaction.
- D. Edging: Install Flush with crushed aggregate blende with admixture. Provide sufficient stakes to secure in place.

3.03 INSTALLATION

- A. General
 - 1. The instruction in section 3.03 are for the installation of GraniteCrete. If an approved alternative is used, contractor shall install per manufacturer's recommendations.
 - 2. Manufacturer's recommendations shall supersede recommendations presented in these specifications.
 - 3. Do not use a vibratory plate to compact the GraniteCrete. Use a lawn roller filled with water to compact the GraniteCrete. Use a 36" drum roller or walk-behind roller in static position for driveways and larger installations. It is highly recommended to use a volumetric truck for driveways and larger installations; if possible, the use of a paver is highly recommended as well.
 - 4. The dry method is for installations up to 500 square feet (most home applications). The wet method is for installations over 500 square feet (most large, commercial installations) and may require the use of a volumetric truck.
- B. GraniteCrete or approved equivalent installation:
 - 1. Mixing Method
 - a. Installations less than 500 square feet may be mixed on-site.
 - b. Installations 500 square feet and over up to 3,000 square feet, must be delivered pre-mixed to the site from a GraniteCrete Inc. approved pre-mix facility. Approved retailers and pre-mix facilities can be found on the company website www.granitecrete.com.
 - c. Installations 3,000 square feet and over up to 5,000 square feet must be supplied by an approved pre-mix facility; GraniteCrete Inc. recommends the use of a volumetric truck.
 - d. Installations over 5,000 square feet require the use of a volumetric truck.
 - e. The volumetric truck must be calibrated for the GraniteCrete mixture. Contact GraniteCrete, Inc. at (800) 670-0849 for a list of approved volumetric truck operators.
 - 2. Installation Depth:
 - a. GraniteCrete shall be installed as a 3-inch thick layer (lift). Compaction rates shall be 88%-92%.
 - 1) Note: GraniteCrete compacts approximately ¼" per 1" of lift.
 - b. Class II permeable base rock shall be installed as a 4-inch thick layer (lift).
 - 3. Mixing Ratio:
 - a. 2 bag mixture: The ratio is 17:1 (17 units of decomposed granite to 1 unit of GraniteCrete, measured in volume).
 - 4. Installation Instructions – Dry Method
 - a. Class II Base Rock: Moisten and compact base rock on the entire installation area to an even depth of 4-inch. A vibratory plate can be used to compact the base rock; it should not be used to compact the GraniteCrete.

- b. GraniteCrete: Wheelbarrow the prepared GraniteCrete/DG mixture to the installation site and place a layer of the mixture to one-half of the desired final lift. Be sure to spread the mixture out before proceeding to step 3; this will ensure the mixture is moistened and mixed thoroughly.
 - c. Moisten the material with a hose end trigger sprayer attachment, avoiding puddling - oversaturation is detrimental and will negatively affect the integrity of the finished product. Rake area lightly to evenly distribute water throughout the mix or "lift". Walking on the area is perfectly acceptable; initial compaction can be performed by walking on the edges and corners.
 - d. Install a second lift as above; when doing this, make sure to pay particular attention to the edges to ensure even material height, and moisten to dampen mixture.
 - e. Moisten until both lifts are damp. Proper moisture content can be checked by clenching your fist around the GraniteCrete, when the mixture just stays together and the color just starts to transfer to your hand, GraniteCrete is ready to compact.
 - f. Compaction: After proper moisture is achieved for compaction, hand tamp (with a 10" hand tamp) around benches, sign posts, corners, boulders, et cetera. Pay particular attention to corners and edges to ensure tight compaction.
 - g. Make several passes with a 36" lawn roller (filled with water), or for larger installations, a 36" walk-behind or drum roller in static position. Hand tamp out any imperfections with a 6" wooden masonry float.
 - h. Make sure to keep your 10" hand tamp, lawn roller, and wooden floats clean at all times. Fill in any divots with fresh, loose material (removing any larger stone) and hand tamp with the wooden floats to match existing finish.
 - i. When laying GraniteCrete in batches, be sure to use the cold joint method below to ensure a blemish-free installation.
 - j. Finishing: Lightly sweep the finished surface in a perpendicular pattern with a medium-bristled push broom. Then make several more passes with the lawn roller until the desired surface texture is achieved. With larger installations, a roller in a static position can be used, making sure to keep the drum clean at all times. Remove spoils off the surface.
 - k. DO NOT ALLOW GRANITECRETE TO DRY DURING INSTALLATION. MIST LIGHTLY WITH A HOSE END SPRAY HEAD AS NECESSARY OR COVER WITH A PLASTIC TARP.
 - l. The final step for a GraniteCrete installation is a dampening with water of all newly-installed and compacted GraniteCrete materials. Using a shower head/spray hose attachment, moisten the entire newly-installed GraniteCrete area - avoid puddling. For best results, moisten all newly-installed GraniteCrete paving a second time the following 1 to 5 days, as practical. Slow curing of GraniteCrete is important to avoid cracking.
 - m. Make sure there is no direct application of uncontrolled water (e.g. irrigation or sprinkler water) prior to final curing.
5. Installation Method – "Wet" Method
- a. After DG and GraniteCrete have been mixed together but BEFORE installation has begun: Mix thoroughly and moisten with water until the GraniteCrete mixture begins to marble or clump together. Squeeze the mixture in your fist and open your hand. When the color has just started to transfer onto your hand and the mixture just begins to stay together in a clump, it's ready for installation
 - b. Class II Base Rock: Moisten and compact base rock on entire installation area to an even depth of 4-inch. A vibratory plate can be used to compact the base rock; it should not be used to compact the GraniteCrete for residential installations.
 - c. GraniteCrete: Wheelbarrow the prepared GraniteCrete/DG to the installation site and spread the mixture over the compacted base rock.

- d. Compaction: Walking on the area is perfectly acceptable; initial compaction can be performed by walking on the edges and corners. Rake or grade area with the flat side of a landscape or asphalt rake (Do not use tang side), until the GraniteCrete is one inch above finish grade.
 - e. Once initial compaction has been completed, hand tamp (with a 10" hand tamp) around benches, sign posts, corners, boulders, et cetera. Pay particular attention to corners and edges to ensure tight compaction.
 - f. Make several passes with a 36" lawn roller (filled with water), or for larger installations, a 36" walk-behind or riding-roller in static position. Hand tamp out any imperfections with a 6" wooden masonry float.
 - g. Make sure to keep your 10" hand tamp, lawn roller, and wooden floats clean at all times. Fill in any divots with fresh, loose material (removing any larger stone) and hand tamp with the wooden floats to match existing finish.
 - h. When laying GraniteCrete in batches, be sure to use the cold joint method below to ensure a blemish-free installation.
 - i. Finishing: If desired, lightly sweep the finished surface in a perpendicular pattern with a medium-bristled push broom. Then make several more passes with the lawn roller until the desired surface texture is achieved. With larger installations, a roller in a static position can be used, making sure to keep drum clean at all times. Remove spoils off the surface.
 - j. DO NOT ALLOW GRANITECRETE TO DRY DURING INSTALLATION. MIST LIGHTLY WITH A HOSE END SPRAY HEAD AS NECESSARY OR COVER WITH A PLASTIC TARP.
 - k. The final step for a GraniteCrete installation is a dampening with water of all newly-installed and compacted GraniteCrete materials. Using a shower head/spray hose attachment, moisten the entire newly-installed GraniteCrete area - avoid puddling. For best results, moisten all newly-installed GraniteCrete paving a second time the following 1 to 5 days, as practical. Slow curing of GraniteCrete is important to avoid cracking.
 - l. Make sure there is no direct application of uncontrolled water (e.g. irrigation or sprinkler water) prior to final curing.
6. You may walk on GraniteCrete immediately after installation. However, like concrete, GraniteCrete gets stronger with time. Ideally, stay off the newly-installed GraniteCrete areas for at least one day; after that, foot traffic is allowed. Vehicular traffic should avoid newly installed areas for 5 – 7 days.
7. Newly installed GraniteCrete paving surfaces are fully cured in 28 days. At that time, the entire surface should be blown or swept off to eliminate loose surface materials. Minor cracking may take place. However, over time, the aggregate fines will fill in the minor cracks and they should disappear. Occasional blowing off of the surface will help to minimize loose surface materials.
8. Cold Joint Method One
- a. "Between pours," stop at an area that makes the joint location look intentional. Take a chalk snap line just back from loose GraniteCrete into the compacted area and create a chalk line. Use either a masonry blade - or a square-nose shovel - and cut a straight line across the installation.
 - b. Continue with installation: Dampen the prior installation area. Place newly mixed GraniteCrete into the area, being careful not to overlap existing compacted material. Place a three foot length of 2"x4" carefully along the edge of the new pour and compact by hitting/tapping the board with a single jack. Then, take a medium-bristled push broom and very lightly "feather" the two pours together
9. Cold Joint Method Two
- a. Place a 2"x4" or 2"x6" piece of wood across the installation, loosely stake it, and finish compacting the material. Leave the board in place overnight.

- b. The next day, carefully lift the wood up and away from the installed GraniteCrete. Continue the installation process as per step 2 under Method One, making sure to dampen the prior installation area.
 - 10. Cold Joint Method Three (Suggested for large open edges at the end of the work day):
 - a. Install steel edging at a location that looks "intentional" and aesthetically "makes sense." Permanently install using the stakes provided. Completely finish the firstday's work.
 - b. The next day, simply continue with the installation. Make sure to dampen the prior installation area first. Leave the edging in place. Again, being careful not to leave any new material on the previously installed GraniteCrete.
 - c.
- C. Important Notes:
 - 1. Non-compacted - or poorly-compacted - GraniteCrete top layer will result in loose and pebbled materials. Edge and corner compaction may require special attention with a hand tamp during installation.
 - 2. Non-compacted - or poorly-compacted - base rock may result in failure of the top layer of GraniteCrete.
 - 3. Squeeze the mixture in your fist and open your hand. When the color has just started to transfer onto your hand and the mixture just begins to stay together in a clump, it's ready for installation. Excessive moisture level may result in "sticky" materials complicating the quality of the finish surface or proper compaction – if you squeeze the mixture and water oozes out, it is too damp. If the material is too wet, it may be placed on the bottom of the installation, with material that has a better moisture content on top.
 - 4. Aggregate/decomposed granite materials should meet the sieve specifications in this Specification Guide
 - 5. Surface shall follow overall contours as shown on the plans. Surface shall be sloped for drainage as shown on the plans.
 - 6. Compaction rates for all applications are 88% – 92%.
 - 7. Please Note: 3/8" minus aggregate comes in different colors. GraniteCrete samples reflect the use of a Golden Granite decomposed aggregates. Mock-ups using local aggregate source is strongly suggested.
 - 8. Saw cut expansion joints every 5' in narrower paths, every 12' in wider paths, and at every engineered stress areas. Wait 48 hours before saw cutting.
 - 9. Cover finished surface, when practical, to achieve maximum curing period.
 - 10. Completed, finished surface shall be of consistent quality and free of deleterious materials such as organic materials, nails, stones, and loose material. Surface shall not have depressions or humps greater than 1/4 inch in ten feet. Cold joints, if any, should be inconspicuous.
- D. Curing Period / Protection
 - 1. Do not allow traffic on crushed aggregate blended with GraniteCrete admixture surfacing for 5 days after placement or until compacted crushed aggregate blended with GraniteCrete admixture surfacing has fully cured. Cover for extended curing period.
 - 2. Protect crushed aggregate blended with GraniteCrete admixture surfacing from damage until project completion. Areas damaged during the process of construction shall be repaired to match specified requirements.
- E. Maintenance and Repairs
 - 1. DO NOT use a pressure washer to clean GraniteCrete. Depending on quality of compaction at time of installation, a thin veneer of loose aggregate material is typical after the full 28 days cure period. If cracking appears in a GraniteCrete surface, broom loose aggregate "fines" into cracks and compact with a rubber mallet.

2. Repair: When repairing GraniteCrete it is important to use the original aggregate/decomposed granite and the original GraniteCrete Admixture color to match previously installed materials. If the paved surface has large areas of raveled material (loose aggregate/decomposed granite) the initial installation may not have been properly compacted, or blended materials did not have optimum moisture content during installation. GraniteCrete must not be allowed to dry prior to final compaction. The following are suggestions for repair of raveled materials:
 - a. For the large loose areas, a minimum of a 3-inch of GraniteCrete can be installed. The repair areas need to be saw-cut at agreed length, removed, and re-installed. A portable concrete mixer or wheelbarrow can be used.
 - b. In areas that collapse/fail due to equipment weight, re-form and re-install with original materials as per specifications.
 - c. Cracks: Repair by brooming existing surface fines into the cracks of filling with dry, pre-mixed materials, or both. The onsite aggregate/decomposed granite should be sieved to 1/8" minus material for better application and in-fill of cracks. Materials should be mixed as per ratio described above. Broom or fill the crack, moisten, compact (with rubber mallet or hand compaction plate) and "feather" material into the final finish. This process might have to be done two or three times.

END OF SECTION

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SECTION 32 17 13**PARKING BUMPERS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes concrete precast wheel stops.

1.02 SUBMITTALS

- A. Follow submittal procedure outlined in accordance with Section 01 10 00, Supplemental General Requirements.
- B. Submit product data for each type of product.

PART 2 - PRODUCTS**2.01 PARKING BUMPERS**

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 2500 psi minimum compressive strength, 5½ inches high by 7½ inches wide by 48 inches long (or length as shown on plans). Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed vertical holes through wheel stop for anchoring to substrate.
 - 1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
 - 2. Mounting Hardware: Galvanized-steel dowel, ½ inch diameter, 24 inch minimum length.

2.02 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Oldcastle Precast
 - 2. Bertelson Precast
 - 3. Barco Products, or approved equal

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring.

- C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION

SECTION 32 17 23**PAVEMENT MARKINGS****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Removal of existing traffic stripes and pavement markers
- B. Removal of existing signs
- C. Cleaning and sweeping of streets before application of traffic stripes and pavement markings
- D. Materials and application for traffic stripes and pavement markings
- E. Materials and application for pavement markers
- F. Traffic control signs and street name signs
- G. Object markers
- H. Survey monuments

1.02 RELATED SECTIONS

- A. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.03 RELATED DOCUMENTS

- A. Caltrans Standard Specifications, 2023
 - 1. Section 78, Incidental Construction
 - 2. Section 81, Miscellaneous Traffic Control Devices
 - 3. Section 82, Signs and Markers
 - 4. Section 84, Markings
- B. Caltrans Standard Plans, 2023
 - 1. Plan A20A through A20D: Pavement Markers and Traffic Lines, Typical Details
 - 2. Plan A24A and A24B: Pavement Markings Arrows
 - 3. Plan A24C: Pavement Markings, Symbols and Numerals
 - 4. Plan A24D: Pavement Markings, Words
 - 5. Plan A24E: Pavement Markings, Words, Limit and Yield Lines
 - 6. Plan A24F: Pavement Markings, Crosswalks
 - 7. Plan A73A: Object Markers
 - 8. Plan A73B: Markers
 - 9. Plan A73C: Delineators, Channelizers and Barricades
 - 10. Plan A74: Survey Monuments
 - 11. Plan RS1: Roadside Sign, Typical Installation Details No. 1
 - 12. Plan RS2: Roadside Sign, Wood Post - Typical Installation Details No. 2
 - 13. Plan RS3: Roadside Sign, Laminated Wood Box Post - Typical Installation Details No. 3
 - 14. Plan RS4: Roadside Sign, Typical Installation Details No. 4
- C. The State of California Traffic Manual, 2014

- D. The regulations, standards, and tests of the State of California Department of Transportation Materials and Research Division, edition in effect at time of date on Plans.
- E. Professional Land Surveyor's Act, Business and Professions Code §§ 8700 – 8805

1.04 SUBMITTALS

- A. Submit product data for each of the following in accordance with Section 01 10 00, Supplemental General Requirements:
 - 1. Traffic paint
 - 2. Pavement markers and adhesives
 - 3. Reflectorized markers and posts

1.05 QUALITY ASSURANCE

- A. Deliver certificates showing conformance with this specification to the Owners Representative with each shipment of materials and equipment to the Project site.
- B. Provide proper facilities for handling and storage of products to prevent damage. Where necessary, stack products off ground on level platform, fully protected from weather.

1.06 PROJECT CONDITIONS

- A. Do not apply traffic striping or pavement markings to the pavement until after approval to proceed has been given by the Owners Representative.
- B. Thoroughly cure new asphalt concrete and portland cement concrete before application of stripes, markings or markers.

PART 2 - PRODUCTS

2.01 THERMOPLASTIC STRIPES AND MARKING

- A. Thermoplastic striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02B, unless noted otherwise herein or on the Plans.
- B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.
- C. Thermoplastic stripes and markings shall have a minimum skid friction value of BPN 35.

2.02 PAINTED STRIPES AND MARKINGS

- A. Painted striping and marking materials shall be in accordance with Caltrans Standard Specifications Sections 84-2.02 and 84-2.02C, unless noted otherwise herein or on the Plans.
- B. Glass Beads shall be in accordance with Caltrans Standard Specification Section 84-2.02D, Glass Beads, unless noted otherwise herein or on the Plans.

2.03 PAVEMENT MARKERS

- A. Pavement Markers shall be in accordance with Caltrans Standard Specification Section 81-3, Pavement Markers, and as indicated on the Plans.
- B. Material
 - 1. Non-reflective Material shall be in accordance with Caltrans Standard Specification Section 81-3.02B, Non-Reflective Pavement Markers.
 - 2. Retroreflective Material shall be in accordance with Caltrans Standard Specification Section 81-3.02C, Retroreflective Pavement Markers.
- C. Adhesive:
 - 1. Adhesive Material shall be in accordance with Caltrans Standard Specification Section 81-3.02D, Hot Melt Bituminous Adhesive.

2.04 TRAFFIC CONTROL SIGNS

- A. General: Traffic control signs shall be in accordance with Caltrans Standard Specification Section 82-1, Signs and Markers.
- B. Sign Panels shall be in accordance with Caltrans Standard Specification Section 82-2, Sign Panels. Conform type (regulatory or warning), size, shape and pattern to the State of California, Department of Transportation, Traffic Manual, edition in effect at the date of the Plans.
- C. Posts:
 - 1. Metal Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02B, Metal Posts.
 - 2. Wood Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02C, Wood Posts.
- D. Mounting Hardware shall be in accordance with Caltrans Standard Specification 82-3.02E, Sign Panel Fastening and Mounting Hardware, unless otherwise specified.
- E. Post Foundations: Conform to Caltrans Standard Plans.

2.05 STREET NAME SIGNS

- A. Conform to manufacturer, style, size, and shape shown on the Plans.
- B. Posts: 2 inch inside diameter steel pipe unless noted otherwise on the Plans. Posts shall be in accordance with Caltrans Standard Specification Section 82-3.02B, Metal Posts.
- C. Post Foundations: Portland cement concrete in accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

2.06 REFLECTORIZED OBJECT MARKERS

- A. Reflectorized Metal Object Markers: In accordance with Caltrans Standard Specification Section 82-5, Markers, for target plates and reflectors, and Caltrans Standard Plans A73A through A73C. Marker type shall be as shown on Plans.
- B. Posts: Metal posts shall be in accordance with Caltrans Standard Specification Section 82-5.02C, Metal Posts, and Caltrans Standard Plan A73B.

- C. Mounting Hardware: In accordance with Caltrans Standard Specification Section 82-5.02G, Hardware.

2.07 STREET SURVEY MONUMENTS

- A. General: In accordance with Caltrans Standard Specification Section 78-2, Survey Monuments, except that the marker disk will not be furnished. Marker disk shall be 2 inch diameter solid brass with a 2 3/4 inch shaft, "Lietz No. 525" or approved equal.
 - 1. Portland Cement Concrete: In accordance with Section 32 13 18, Cement and Concrete for Exterior Improvements.

PART 3 - EXECUTION

3.01 REMOVAL OF TRAFFIC STRIPES, PAVEMENT MARKINGS AND PAVEMENT MARKERS

- A. Where blast cleaning is used for the removal of painted traffic stripes and pavement markings, or for removal of objectionable material, remove the residue, including dust and water, immediately after contact with the surface being treated. Remove by a vacuum attachment operating concurrently with the blast cleaning operation.
- B. Where grinding is used for the removal of thermoplastic traffic stripes and pavement markings; remove the residue by means of a vacuum attachment to the grinding machine. Do not allow the residue to flow across or be left on, the pavement.
- C. Where markings are to be removed by blast cleaning or by grinding, the removed area shall be approximately rectangular so that no imprint of the removed marking remains on the pavement.
- D. Waste from removal of yellow painted traffic stripe may contain lead chromate. Residue produced when yellow paint is removed may contain heavy metals in concentrations that exceed thresholds established by the California Health and Safety Code and may produce toxic fumes when heated. As such, when grinding or other methods approved by the Owner's Representative are used to remove yellow painted traffic stripes, the removed residue, including dust, shall be collected and contained immediately. The Contractor shall submit a written work plan for the removal, storage, and disposal of yellow painted traffic stripe to the Owner's Representative for approval not less than fifteen (15) days prior to the start of the removal operations. Removal operations shall not be started until the Owner's Representative has approved the work plan.
- E. Contractor will be responsible for repairing any damage to the pavement during removal of pavement markers. Damage to the pavement, resulting from removal of pavement markers, shall be considered as any depression more than 1/4-inch deep.

3.02 TEMPORARY PAVEMENT MARKERS

- A. If permanent pavement markers cannot be installed immediately, and the street or road is to be placed in service, install short term, temporary pavement markers on the new pavement prior to opening the street or road to traffic.
- B. Place markers, at a minimum, of 24 feet on centers, or as required by the governmental agency having jurisdiction, in the appropriate colors to delineate centerlines and travel lanes on multi-lane roadways.

3.03 THERMOPLASTIC TRAFFIC STRIPES AND PAVEMENT MARKINGS

- A. Apply in conformance with the manufacturer's instructions and the applicable requirements Caltrans Standard Specification Section 84-2.03, Construction, and Caltrans Standard Plans A20A through A20D, and A24A through A24E.

3.04 PAINTED TRAFFIC STRIPES AND PAVEMENT MARKINGS

- A. Apply in conformance with the manufacturer's instructions and the applicable requirements of Caltrans Standard Specification Section 84-3.03, 3.04 and 3.05 and Caltrans Standard Plans A20A through A20D, and A24A through A24F.

3.05 PAVEMENT MARKERS

- A. Place in accordance with Caltrans Standard Specification Section 81-3.03, Construction.
- B. Pavement recesses are not required. Markers shall be installed accurately to the line established by the Owner's Representative. No markers shall be installed until the surface has been approved by the Owner's Representative.

3.06 TRAFFIC CONTROL SIGNS

- A. Install in accordance with Caltrans Standard Specification Sections 82-2.03 and 82-3.03, Caltrans Standard Plan RS1, the applicable requirements of the State of California Department of Transportation Maintenance Manual and the details shown on the Plans. The horizontal locations shown on Caltrans Standard Plan RS1 shall not be applicable, the horizontal location shall be as shown on the Plans.
- B. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.
- C. After erection, damage to traffic sign faces shall be touched up or the sign replaced.

3.07 STREET NAME SIGNS

- A. Install in accordance with the manufacturer's instructions and as shown on the Plans.
- B. Horizontal location shall be as shown on the Plans.
- C. Portland cement concrete for post foundations shall be of the configuration shown on the Plans.

3.08 REFLECTORIZED OBJECT MARKERS.

- A. Install in accordance with Caltrans Standard Specification Section 82-5.03, Construction, except that the metal marker posts shall not be driven in place without prior approval of the Owner's Representative.
- B. Install at locations shown on the Plans.

3.09 STREET SURVEY MONUMENTS

- A. Install Survey Monuments in accordance with Caltrans Standard Specification Section 78-2.03, Construction and Caltrans Standard Plan A74, except that the marker disk will not be

furnished. Exact point in marker to be determined by an accurate survey and placed by a California Licensed Land Surveyors in accordance with the Professional Land Surveyors' Act.

3.10 PROTECTION

- A. Protect the newly installed traffic stripes and pavement markings from damage until the material has cured.
- B. Replace any traffic stripes or pavement markings or markers broken, misaligned or otherwise disturbed prior to opening roadway to traffic.

3.11 RESTORATION OF EXISTING IMPROVEMENTS

- A. Existing signs striping or other markings removed or damaged due to the installation of new facilities shall be replaced in kind.
- B. Existing landscaping or planting removed, damaged or disturbed due to the installation of traffic control signs or street name signs shall be replaced in kind.

END OF SECTION

SECTION 32 80 00**IRRIGATION - ALTERNATE #5****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Requirements of Contractor for design-build work, where specified and identified in the various Sections of the Specifications that are part of the Project scope, including the following:
 - 1. Trenching, stockpiling, excavation, materials, and refilling trenches.
 - 2. Furnishing materials and installation for complete system including piping, valves, fittings, sprinkler heads, dripline and fittings, automatic controls, and final adjustment of heads to ensure complete coverage.
 - 3. Line voltage connections to the irrigation controllers and low voltage control wiring from controllers to remote control valves.
 - 4. Replacement of unsatisfactory materials.
 - 5. Re-sod or seed all irrigation trenches through existing sod areas.
 - 6. Clean-up, inspection, and approval.
 - 7. All work of every description mentioned in the Specification and/or Addenda.
 - 8. All labor and materials reasonably incidental to the satisfactory completion of the work, including clean-up of the site, as directed by the Project Representative.
 - 9. Tests, including permits and water calculations.
 - 10. Compliance with local, County, and State irrigation requirements.
 - 11. As-built drawings.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Sections
 - 1. Division 01 - General Requirements: For alternates.
 - 2. Section 32 90 00 - Planting: Provision of planting.

1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
 - 1. D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 2. D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 3. D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - 4. D2287 - Standard Classification System and Basis for Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
 - 5. D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 6. D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - 7. D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 8. D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- B. NEC - National Electric Code, 2022 Edition

- C. NSF - National Sanitation Foundation
- D. OSHA - Occupational Safety and Health Administration
- E. UL- Underwriters Laboratories
- F. UPC - Uniform Plumbing Code, 2022 Edition

1.03 MEASUREMENT AND PAYMENT

- A. Irrigation System
 - 1. Measurement: Irrigation system installation is measured on a lump sum basis.
 - 2. Payment: The contract lump sum price paid for the Irrigation System shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing the Irrigation System, complete in place.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer catalog information on all material to be used on the project as specified on the legend, notes, details, and plans. Redline or highlight exact items on page to be submitted. Complete material list shall be submitted prior to performing any work.
- B. Submit Delegated Design Irrigation and Landscape Design Plans and water calculations per County and State requirements, signed by licensed Landscape professional.
- C. Project As-built Record Documents
 - 1. The Contractor shall maintain in good order in the field office, one complete set of black line prints of all sprinkler drawings which form a part of the contract, showing all water lines, electrical, sprinklers, valves, and stub-outs. In the event any work is not installed as indicated on the Drawings, such work shall be corrected and documented accurately on the working drawings.
 - 2. Dimension from two permanent points of reference, such as building corners, sidewalks, road intersections or monuments, the following items:
 - a. Connection to water source.
 - b. Backflow preventor.
 - c. Gate valves.
 - d. Routing of pressurized mainlines and lateral lines.
 - e. Remote control valves.
 - f. Quick coupling valves.
 - g. Flow sensor, master valve, and irrigation controller.
 - 3. Deliverables shall be one full size colored hard copy of the Contract Drawings with redlines and dimensions or a full sized colored scanned PDF version.
- D. Controller Chart
 - 1. Provide one laminated (hermetically sealed between two pieces of 10 mil. plastic) controller chart showing the area covered by controller for each automatic controller supplied at the maximum size controller door will allow. Chart shall be a reduced drawing of the actual "as-built" system. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed folded, in a sealed plastic container, inside the controller door.
 - 2. Controller chart shall be a blackline print with a different color used to show area of coverage for each station. Charts must be completed and approved by the Project Representative prior to final inspection of the irrigation system.

3. Locate all dripline flush valves and dripline indicators on colored plans if the locations differ from design plans.
- E. Controller Cloud Based Communication and Flow Sensor Installation Confirmation
1. Provide written confirmation that the cloud-based communications are set up and operational between controller(s) and cloud-based server.
 2. If controller is a two-wire type controller, provide confirmation that the controller is communicating with each decoder valve on system and there are no error messages logged on the cloud-based communication system. Provide a printout of information to Landscape Architect or Irrigation Consultant.
 3. Provide written confirmation from the distributor/manufacture's representative that the controller is communicating with flow sensors and that the correct "k" and "offsets" are setup and utilized properly. The "k" and "offsets" are pre-set numbers you plug into the controller software based on the flow sensor size and type when calibrating the flow sensor. Confirm that flow values have been "learned" and recorded for each valve on the controller, and the correct gpm per valve is shown and verified on a printout and provided to Landscape Architect or Irrigation Consultant. Flow alarms and automatic shut offs should be set up after plant establishment.
- F. Maintenance and Operating Instructions and Manuals
1. Contractor shall prepare an Operation and Maintenance Manual, organized in a 3-ring binder, containing the following information.
 - a. Contractor's name, address, and telephone number, duration of guarantee, periods as specified herein, list of equipment with names and addresses of local manufacturer's representatives with duration of written warranties. Complete operating and maintenance instructions on all equipment spare parts lists and related manufacturer's information.
 2. Submit the Operation and Maintenance Manual to the Project Representative within 10 calendar days of completion of work of this Section and as a condition of project acceptance.
 3. Irrigation Audit, Irrigation Survey, and Irrigation Water Use Analysis: All landscape irrigation audits shall be conducted by a local agency landscape irrigation auditor or a third-party certified landscape irrigation auditor. Landscape audits shall not be conducted by the person who design the landscape or installed landscape.

1.05 QUALITY ASSURANCE AND GENERAL REQUIREMENTS

- A. Qualifications: The Contractor, personally or through an authorized and competent representative, shall supervise the work constantly, and shall, as far as possible, keep the same foreman and workmen on the job from commencement to completion. The workmanship of the entire job must in every way be first class, and only experienced and competent workmen will be allowed on the job. A minimum of five years' experience of installing irrigation systems of similar scope, size and complexity as the system being installed under this scope of work is required for all on-site job superintendents.
- B. Manufacturer's Installation Instructions and Best Practices: Manufacturer's installation instructions shall be followed in all cases when not shown in the Drawings or Specifications.
- C. OSHA. Compliance: All articles and services covered by this specification shall meet or exceed the safety standards established under the Federal Occupational Safety and Health Act of 1970, together with all amendments in effect as of the date of this Specification.

- D. All irrigation systems shall be installed to meet or exceed the requirements set forth in the California Department of Water Resources Model Water Efficient Landscape Ordinance.
- E. Codes and Standards: Comply with all applicable codes and standards.
 - 1. All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code; published by the Western Plumbing Officials Association; California Code of Regulations, Title 23, Division 2. Department of Water Resources, Chapter 2.7. Model Water Efficient Landscape Ordinance; and other State or local laws regulations. Nothing in the Drawings or Specifications is to be construed as to permit work not conforming to these codes.
 - 2. When the specifications call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, the provision of the specifications shall take precedence over the requirements of said rules and regulations.
 - 3. Contractor shall furnish, without extra charge, any additional material and labor when required by the compliance with these rules and regulations, though the work be not mentioned in these particular Specifications or shown on the Drawings.
 - 4. The Contractor shall erect and maintain barricades, guards, warning signs, and lights as necessary or required by OSHA regulations for the protection of the public or workmen.
 - 5. Any existing buildings, equipment, piping, pipe covering sewers, etc., damaged by the Contractor during the course of his work shall be replaced or repaired by the Contractor in a manner satisfactory to the Project Representative and at Contractor's own expense, before final payment is made. The Contractor shall be responsible for damage caused by leaks in the piping systems being installed or having been installed under this contract. He/she shall repair, at his/her own expense, all damage so caused, in a manner satisfactory to the Project Representative.
 - 6. The Contractor shall pay for all permits, licenses, and fees required.
- F. All equipment or materials installed or furnished without prior approval of the Project Representative may be rejected and the Contractor may be required to remove the equipment or material at their own expense.

1.06 EXISTING CONDITIONS

- A. Protection of Existing Structures and Utilities
 - 1. The Drawings show, if applicable, existing above- and below-grade structures and utilities that are known to the Project Representative. Locate known existing installations before proceeding with construction operations that may cause damage to such installations. Existing installations shall be kept in service where possible and damage to them shall be repaired with no adjustment of Contract Sum. Verify with Project Representative if as-built drawings are available.
 - 2. If other structures or utilities are encountered, request Project Representative to provide direction on how to proceed with the Work. If a structure or utility is damaged, take appropriate action to ensure the safety of persons and property.
- B. Trench Interference with Existing Tree Root Systems: Prior to trenching, layout main and lateral line locations within drip line of trees and review locations with Project Representative. Relocate any lines that may interfere with existing root systems to avoid or reduce damage to root systems as accepted by Project Representative.
- C. Provide barricades, coverings, warning signs, lights, and other protection required by local code or OSHA to prevent damage to existing improvements to remain and to protect the public.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protection: Use all means necessary to protect irrigation system materials before, during, and after installation and the installed work and materials of all other trades.
- B. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the satisfaction of the Project Representative and at no additional cost to the project.
 - 1. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install; transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load. Protect pipe from sunlight.
 - 2. Repair all dented and damaged pipe by cutting out the dented or damaged section and rejoining with a coupling.

1.08 LAYOUT OF WORK

- A. The Contractor shall stake out the irrigation system as shown on the Drawings. These areas shall be checked by the Contractor and Project Representative before construction is started. Any changes, deletions, or additions shall be determined at this check.
- B. Due to the scale of the Drawings, it is not possible to indicate all piping offsets, fittings, sleeves, etc., which may be required. Carefully investigate the conditions affected by all of the work, plan accordingly, and furnish all required fittings. Install system in such a manner to avoid conflicts with planting, utilities and architectural features.
- C. Do not install the irrigation system as shown on the Drawings when it is obvious in the field that obstructions, grade differences or discrepancies in arc dimensions exist that might not have been considered. Bring such obstruction or differences to the attention of the Project Representative. Notify and coordinate irrigation Work with applicable contractors for location and installation of piping and sleeves through or under walls, pavement, and structures. In the event this notification is not given, the Contractor shall assume full responsibility for any revision necessary.

1.09 SEQUENCING AND SCHEDULING

- A. Acceptance: Do not install main line trenching prior to acceptance by Project Representative of rough grades completed under another Section.
- B. Coordination: Coordinate with all other trades the sleeving, power requirements of the project, prior to the start of construction.

1.10 INSTRUCTION

- A. After the system has been installed and approved, the Contractor shall instruct the Project Representative and/or Maintenance Contractor, in complete operation and maintenance of the irrigation system.

PART 2 - PRODUCTS**2.01 PIPE AND FITTINGS**

- A. PVC Pressure Mainline Pipe and Fittings
 - 1. Pressure Mainline Piping: 2 inches and smaller shall be PVC 1120-Schedule 40 plastic pipe. Pipe shall be made from NSF approved Type 1, Grade 1 PVC compound conforming to ASTM D1785.

2. Schedule 40 pipe shall be manufactured in strict compliance to ASTM D1785 and D2665 (where applicable), consistently meeting and/or exceeding the Quality Assurance test requirements of these standards with regard to material, workmanship, burst pressure, flattening, and extrusion quality.
 3. All PVC pipe shall bear the following markings:
 - a. Manufacturer's name.
 - b. Nominal pipe size.
 - c. Class or Schedule.
 - d. Pressure rating in PSI.
 - e. NSF.
 - f. Date of extrusion.
 4. Use solvent weld pipe for mainline pipe with a nominal diameter less than 3 inches or where a pipe connection occurs in a sleeve. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 at changes in direction or branch mains. Use primer approved by the pipe manufacturer. Solvent cement shall conform to ASTM D2564.
 5. Connections between main lines and RCV's shall be of Schedule 80 PVC (threaded both ends) nipples and fittings.
 6. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable I.P.D. schedule, and NSF Seal of approval.
 7. Inside diameter of pipe shall be the same size as iron pipe.
 8. PVC Type I shall not be threaded.
 9. PVC fittings shall be PVC Type II, Schedule 40 NSF approved.
 10. Caution shall be utilized in handling Type I pipe due to the possibility of cracking or splitting.
 11. When connection is plastic to metal, male adapters shall be used unless otherwise noted or detailed. The male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead based (Teflon paste, or approved equal).
 12. Threaded Nipples: ASTM D2464, Schedule 80 with molded threads.
 13. Copper Main Lines: Use appropriate wrought fittings at changes of direction or branch mains as approved by the Uniform Plumbing Code.
- B. PVC Non-Pressure Lateral Line and Fittings
1. Lateral Lines (Non-pressure): 3/4-inch and larger shall be Schedule 40 PVC plastic pipe manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM D1784; cell classification 12245-B, Type 1, Grade 1.
 2. Fitting: All lateral lines shall be connected with Schedule 40, Type I, Grade I, PVC solvent weld fittings.
 3. Thread: Injection-molded type (where required).
 4. Tees and Ells: Side-gated.
 5. Threaded Nipples : ASTM D2464, Schedule 80 with molded threads.
 6. Refer to "trenching and backfilling" elsewhere in these Specifications for minimum depths.
- C. Solvent for all PVC pipe shall be #711 Gray, along with #P-70 primer, NSF approved as manufactured by Industrial Polychemical Service, Gardena, California, or approved equal.
- D. Pipe joint compound shall be non-hardening, non-toxic materials designed specifically for use on threaded connections in water carrying pipe. Performance shall be same as RectorSeal #5.
- E. PVC Flexible Pipe: Extruded from flexible vinyl chloride compound.
1. 1/2-inch pipe, 0.50-inch inside diameter, 0.090-inch wall thickness.
 2. Material shall conform to ASTM D2287.

- F. Swing joints shall be as shown on construction details.

2.02 SLEEVES

- A. Sleeve below all hardscape elements with SCH 40 or Class 200 PVC twice the diameter of the pipe or wire bundle within, or as delineated on the plans.
- B. Under Hardscape Crossings: Sleeves shall extend a minimum of 24 inches beyond all sidewalks or shall be extend 24 inches beyond the back edge of the curb, where noted on the plans.

2.03 MASTER CONTROL VALVE

- A. Master control valve shall be a normally open 24 VAC solenoid actuated globe pattern valve.
- B. Valves shall be made of brass with a minimum pressure rating of 150 PSI.
- C. Valve shall have external and internal bleed for manual operation.
- D. Valve model and size shall be as shown on Drawings.

2.04 FLOW SENSORS

- A. Inline flow sensors shall be installed in accordance with the manufacturer's installation instructions. Contractor is responsible for the installation, all required materials, and connections of the flow sensors for complete operation with the irrigation controller.
- B. Flow sensor size and model shall be listed on the Drawings.

2.05 FLOW SENSOR CABLE AND CONDUIT

- A. Flow sensor wire shall be shielded cable Paige model 7171D, or approved equal.
- B. Maximum cable distance from controller to flow sensor shall be 2000 ft.
- C. Install flow sensor cable in a 1-inch grey SCH 40 PVC conduit with long sweep elbows.
- D. Conduit and flow sensor cable shall be routed with mainline wherever possible. Provide a minimum 6-inch separation between conduit and pressure main line.
- E. Provide 10-inch round gray electrical pull boxes a minimum of every 200 ft, at each change in direction and adjacent to each controller. Heat brand lid of pull box "FSB".

2.06 GATE VALVES

- A. Gate valves 2 inches and smaller shall meet the following requirements:
 - 1. Valves shall be of stainless steel (304 or higher) or bronze/brass construction with non-rising stem, cross handle and threaded connections.
 - 2. Valves shall be Leemco Model #LGT-SS, Nibco T-113-K, or approved equal. Size as shown on the Drawings.
 - 3. Install in 10-inch diameter plastic valve box as detailed.

2.07 QUICK COUPLING VALVES

- A. Quick coupling valves shall be as shown on the Drawings.

- B. Install in 10-inch diameter plastic valve box as detailed.

2.08 CONTROLLERS

- A. Controller's size and model shall be as listed on the Drawings.
- B. Final location(s) of controller shall be approved by the Project Representative.
- C. Controller requires 120v power. Maximum power output of controller is 2.5 amps.
- D. Install controller and accessories as detailed and per manufacturer's details.

2.09 CONTROL WIRE

- A. Irrigation Low Voltage Control Wire: All wiring to be used for connecting the automatic controller to the electric solenoid actuated remote control valve shall be Type UF-600V, solid copper, PVC insulation, single conductor, UL approved underground feeder cable, approved for direct burial.
- B. Control Wire: Size #14-1 wire with an insulating jacket of color other than white or yellow. Runs over 2,000 lineal feet shall be size #12-1.
- C. Common ground wire: Size #12-1 wire with a white insulating jacket.
- D. Spare Wires: Size #14-1 wire with a yellow insulating jacket. Provide a minimum of two spare control wires into each RCV box for future.
- E. Provide different color (not yellow) control wires for each controller and a separate ground wire for each controller.
- F. Splices shall be made with 3M-DBY seal packs.

2.10 ELECTRIC REMOTE CONTROL VALVES

- A. Electric remote control valves sizes shall be shown on Drawings.
- B. Electric remote control valve shall be a normally closed 24 VAC solenoid actuated globe pattern valve.
- C. Valves shall be made of durable glass-filled nylon with a minimum pressure rating of 150 PSI.
- D. Valve shall have external and internal bleed for manual operation.
- E. Valves shall have one Schedule 80 PVC FIPT threaded true union ball valve with EPDM Orings on the upstream side of valve and one Schedule 80 union on the downstream side of valve. Ball valve shall be Spears True Union model 2000, Asahi Type 21, or approved equal. Match valve size when sizing ball valve and union.
- F. All valves that service dripline or drip systems shall include a plastic wye filter and pressure regulator on the valve or a solid set 40 PSI plastic regulator downstream of the valve. Filters shall be rated to 120 psi, includes a 150 mesh disk or stainless steel screen.

2.11 IDENTIFICATION TAG

- A. Identification tags for all electric control valves shall be manufactured by Christy. Tag numbers shall match stationing in controller and as shown on as-built drawings. Provide one yellow station number tag for each electric control valve as follows:
1. Potable Water Systems: Christy ID.STD.Y1

2.12 VALVES BOXES

- A. Electric Remote Control Valve Boxes
1. All electric remote control valve boxes that service non-drip systems shall be installed within a Carson model 1419 (14"x19") or 1220 (13" x 20") plastic valve box with bolt-down plastic lid, or approved equal. Size of box is dependent on the size of valve. Lid shall be marked "Irrigation Control Valve."
 2. All electric remote control valve boxes that service dripline or drip systems shall be installed within a Carson model 1220 plastic valve box with bolt down plastic lid, or approved equal. Lid shall be marked "Irrigation Control Valve."
 3. Use black colored boxes in shrub and groundcover areas and green in turf areas.
 4. Heat brand controller letter and numbers into lid. Minimum text height shall be 2 inches.
- B. Gate Valve and Quick Coupling Valve Boxes
1. All gate valve and quick coupling valve shall be installed within a Carson Model 91018" depth plastic valve box with plastic lid, or approved equal. Use 8-inch or 10-inch sleeve to encase gate valve.
 2. Use black colored boxes in shrub and groundcover areas and green in turf areas.
 3. Heat brand the letters "GV" into lid. Minimum text height shall be 2 inches.
 4. Drip Component Boxes: All drip components shall be installed within a 6-inch round black plastic valve box with plastic lid. Carson Model 708 plastic valve box with plastic lid, or approved equal.

2.13 SPRINKLER HEADS

- A. All sprinkler heads shall be as listed on the Drawings.
- B. Pop-up spray sprinklers shall include a built-in check valve in the body to hold up to 14 feet of head.
- C. Pop-up spray sprinklers shall include built in pressure regulation in the body.
- D. Use 30 psi regulators for all spray nozzles and 45 psi regulators for all rotating nozzles. Use 12-inch pop-ups in shrub and ground cover areas and 6-inch pop-ups in turf areas.
- E. Riser units and nipples shall be the same size as the inlet to the sprinkler body.

2.14 BUBBLERS

- A. Bubblers shall be as listed on the Drawings.
- B. Bubblers shall be pressure compensating from 20 psi to 60 psi.
- C. The bubbler body shall be manufactured with UV Stabilizers and have 1/2-inch FIPT threads for connection to 1/2-inch MNPT male adaptor or nipple.
- D. Flow rate molded onto the bubbler for easy identification.

- E. Where low head drainage occurs, each bubbler shall have a check valve installed. Hunter HC-50F-50M, or approved equal.

2.15 DRIPLINE AND DRIPLINE COMPONENTS

- A. Dripline shall be as listed on the Drawings.
- B. Tubing shall be low density, UV resistant, polyethylene tubing with internal pressure compensating, drip emitters impregnated into the tubing spaced at 12 or 18 inches.
- C. The built-in emitters shall be capable of delivering 0.6 gallons per hour per emitter.
- D. All dripline systems shall have a manual flush valve at each isolated zone within the systems. Multiple flush valves may be required per drip zone.
- E. All dripline systems shall have air relief valve(s) at the highest elevation point(s) within each isolated zone. Install one air relief valve for every 500 linear feet of dripline.

2.16 CHECK VALVE

- A. Spring check valve shall be Schedule 40 PVC with 1/2-lb spring and stem rated at 150 PSI.
- B. Check valves shall be NDS. Use KSC series swing check valve for all uphill flow direction valves and KC series spring check for all downhill flow direction valves. Size per line size of lateral line.

2.17 MISCELLANEOUS INSTALLATION MATERIALS

- A. Solvent cement and primer for solvent weld joints shall be of make and type approved by manufacturer(s) of pipe and fittings. Cement shall be maintained at proper consistency throughout use.
- B. Pipe joint compound shall be non-hardening, non-toxic materials designed specifically for use on threaded connections in water carrying pipe. Performance shall be same as RectorSeal #5.

2.18 MISCELLANEOUS EQUIPMENT

- A. Provide all equipment called for by the Drawings.
- B. Provide to the Project Representative at completion of the maintenance period, three (3) each of all operating and servicing keys and wrenches required for complete maintenance and operation of all heads and valve. Include all wrenches necessary for complete disassembly of all heads and valves.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Schedule and coordinate placement of materials and equipment in a manner to effect the earliest completion of work in conformance with construction and progress schedule.

3.02 HANDLING AND STORAGE

- A. Protect work and materials from damage during construction and storage as directed by the Project Representative.
- B. Handle plastic pipe carefully; especially protect it from prolonged exposure to sunlight. Any section of pipe that has been damaged will be discarded and removed and replaced if installed.

3.03 LAYOUT

- A. Lay out work as accurately as possible in accordance with diagrammatic drawings.
- B. Where site conditions do not permit location of piping, valves and heads where shown, notify Project Representative immediately and determine relocation in joint conference.
- C. Prior to installation, the Contractor shall stake out the routing of all pressurized main lines and sprinkler heads for approval by Project Representative.
- D. Run pipelines and automatic control wiring in common trenches wherever practical.

3.04 EXCAVATING AND TRENCHING

- A. Work shall be performed when soils are reasonably dry and not saturated.
- B. Trenching
 - 1. Excavations shall be open vertical construction sufficiently wide to provide free working space around the work installed and to provide ample space for backfilling and compacting.
 - 2. In existing turf areas, remove sod with sod cutter. Roll and set aside. Replace immediately after installing conduit (three days maximum), backfilling and compacting.
 - 3. Depth of trenches shall be pipelines deep enough to provide minimum cover from finish grade as follows.
 - a. 18 inches minimum cover over main lines to control valves and quick coupling valves.
 - b. 18 inches minimum cover over control wires from controller to valves.
 - c. 12 inches minimum cover over RCV controlled lateral lines to sprinkler heads.
 - 4. Trenches shall be excavated to such depths as will permit the pipe to be laid at the elevations, slopes, or depths of cover indicated on the Drawings, and at uniform slopes between indicated elevations.
 - 5. Whenever cobbles larger than 2 inches in size are present in earthen subgrade, the trench section shall be excavated to the lines required. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed and consolidated. Trenches shall be excavated with approximately vertical sides between the elevation of the bottom of the pipe and an elevation one foot above the top of the pipe.
 - 6. When two pipes are to be placed in the same trench, maintain a 6-inch space between pipes as minimum.
 - 7. Where other utilities interfere with irrigation trenching and pipe work, adjust the trench depth as instructed by the Project Representative.
 - 8. Restore surfaces, existing underground installations, etc., damaged or cut as a result of excavations, to original conditions in a manner approved by the Project Representative.

- C. Backfilling
1. Backfill materials shall be approved native soil in all landscaped areas. Unsuitable material, including clods and rocks over 2 inches in size shall be removed from the premises by Contractor and disposed of legally at no cost to the Project Representative.
 2. Backfill only after piping has been tested, inspected, and approved.
 3. Place backfill materials in 6-inch layers and compact by jetting or tamping to a minimum compaction of 90 percent of original soil density.
 4. Dress off areas to finish grades and remove excess soil, rocks, or debris remaining after backfill is completed.
 5. All backfilling shall be properly compacted so as to avoid future settlement.
 6. If settlement occurs along trenches, and adjustments in pipes, valves and sprinkler heads, soil, sod or paving are necessary to bring the system, soil, sod or paving to the proper level or the permanent grade, the Contractor, as part of the work under this Contract, shall make all adjustments without extra cost to the project.

3.05 INSTALLATION OF SLEEVING UNDER ASPHALT OR CONCRETE

- A. General: Layout of the piping system shall be per the Drawings and to the depth specified above.
- B. Under Existing Pavement
1. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving, except that no hydraulic driving will be permitted under asphaltic concrete pavement.
 2. Where cutting of existing pavement is necessary, provide alternate routes for vehicular traffic. After placement of pipes, backfill trench and compact to 95 percent. Replace entire section of base rock and hardscape to match existing conditions.
- C. Inspection of Pipe and Fittings: Carefully inspect all pipe fittings before installation, removing all dirt, scale, and burrs; ream as required. Install all pipe with all markings up for visual inspection and verification.
- D. Installation of Sleeving
1. Sleeving shall be installed a minimum of 24 inches below grade.
 2. Sleeving shall extend 24 inches beyond the edge of finished concrete surface.
 3. Trenches containing sleeves shall be backfilled with material that consists of unwashed creek or bank gravel, crushed gravel, crushed rock, sand, or a mixture of these materials. It must be free from roots, vegetable matter, or other deleterious substance and shall be of such nature and so graded that it will bind readily when watered and compacted. Backfill with such material to the bottom of the concrete or hardscape section and compacted to a minimum of 90 percent. Where the sleeve extends beyond the edge of the hardscape or concrete, the sleeve shall be backfilled with native soil or imported topsoil, whichever is specified. If nothing is specified, use previously excavated native soil.
 4. Prior to placement of concrete, the ends of the sleeves shall be marked with a stake that shall be exposed approximately 2 inches – 3 inches above rough or finished grade to identify sleeve locations. On all street crossings, the location shall be marked at the edge of concrete or hardscape with a chiseled line or "X", and the stake removed.

3.06 ASSEMBLING PIPELINES

- A. PVC pipe shall be installed in a manner which will provide for expansion and contraction as recommended by the pipe manufacturer. Pipe routing is diagrammatic and shall be installed in such a manner as to conform with the details.

- B. In joining, use only the specified solvent and make all joints in strict accordance with the manufacturer's recommended methods. Give solvent welds at least 16 minutes set-up time before moving or handling and 24 hours curing time before filling with water.
- C. All pipe shall be assembled free from dirt and pipe scale. Field cut ends shall be reamed only to full pipe diameter with rough edges and burrs removed.
- D. Install 3-inch wide detectable warning tape above all pressurized main lines as shown in the details. Use Christy model #TA-DT-3-BIRR for potable irrigation systems.
- E. Solvent Weld Joint
 1. Prepare joint by first making sure the pipe end is square. Then, de-burr the pipe end and clean pipe and fitting of dirt, dust and moisture.
 2. Dry insert pipe into fitting to check for proper sizing. Pipe should enter fitting 1/3 to 2/3 depth of socket.
 3. Coat the inside socket surface of the fitting and the male end of the pipe with P-70 primer (manufactured by Weld-On). Then without delay, apply Weld-On 711 cement liberally to the male end of the pipe and also apply 711 cement lightly to the inside of the socket. At this time, apply a second coat of cement to the pipe end.
 4. Insert pipe immediately into fitting and turn 1/4-turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Check alignment of the fitting. Pipe and fitting shall be aligned properly without strain to either.
 5. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the pipe and fitting.
 6. Cure joint a minimum of thirty (30) minutes before handling, at least six (6) hours before allowing water in the pipe.
- F. Threaded Joint
 1. Field threading of plastic pipe or fittings is not permitted. Only factory formed threads will be permitted.
 2. Factory made nipples shall be used wherever possible. Field cut threads in metallic pipe will be permitted only where absolutely necessary. When field threading, cut threads accurately on axis with sharp dies.
 3. All threaded joints shall be made up with pipe joint compound. Apply compound to male threads only.
 4. Where assembling metallic pipe to metallic fitting or valve, not more than three (3) full threads shall show when joint is made up.
 5. Where assembling to threaded plastic fitting, take up joint no more than one full turn beyond hand tight.
 6. Where assembling plastic pipe, use strap type friction wrench only; do not use metal-jawed wrench.
- G. Cap or plug openings as pipeline is assembled to prevent entrance of dirt or obstructions. Remove caps or plugs only when necessary to continue assembly.
- H. Where pipes or control wires pass through sleeves, provide removable non-decaying plug at ends of sleeve to prevent entrance of earth.
- I. For plastic-to-steel connections, work the steel connections first; use a non-hardening nonlead base pipe dope on all threaded plastic-to-steel connections and use only light wrench pressure. All plastic-to-steel connections shall be made with SCH 80 PVC nipple or plastic male adapters.

3.07 REMOTE CONTROL VALVES

- A. Install where shown on Drawings and group together where practical. Limit one remote control valve per box.
- B. Locate valve boxes 12 inches from and perpendicular to walk edges, buildings, and walls. Provide 12 inches between valve boxes where valves are grouped together.
- C. Thoroughly flush main line before installing valves.
- D. Install in shrub or groundcover areas where possible.
- E. Label control line wire at each valve with an I.D. tag, indicating identification number of valve (controller and station number). Attach label to control wire.
- F. Flow control stems shall be adjusted or tuned per manufacturer recommendations.
- G. Install 18GA 1/2-inch x 1/2-inch square stainless-steel Type 304 wire mesh under all valve boxes and wrap up the sides of the valves. Adhere wire mesh to sides of box with stainless-steel screws and washers as required. Refer to details for more information.

3.08 AUTOMATIC CONTROLLER

- A. Provide and install automatic irrigation controller in approximate locations shown on Drawings. The exact location will be determined on the site by the Project Representative. Provide conduit and wire and connect to 120-volt switch accessible to controller for ease of maintenance.
- B. Connect control lines to controller in sequential arrangement according to assigned identification number on valve. Each control line wire shall be labeled at controller with a permanent non-fading label indicating station number of valve controlled. Attach label to control wire.
- C. Provide each irrigation controller with its own independent low voltage common ground wire.

3.09 SPRINKLER HEADS AND BUBBLERS

- A. All sprinkler heads shall be set perpendicular to finish grade of the area to be irrigated unless otherwise designated on the plans.
- B. In lawn areas, all sprinkler heads shall be offset a minimum of 3 inches and a maximum of 6 inches from the edge of adjacent hardscape.
- C. Flush and adjust irrigation outlets, bubblers, and nozzles for optimum performance and to prevent overspray onto field, walks, roadways, and/or buildings as much as possible. This shall include selecting the best degree of arc and radius to fit the existing site conditions and throttle the flow control at each valve to obtain the optimum operating pressure for each control zone.

3.10 QUICK COUPLING VALVES

- A. Thoroughly flush lines before installing quick coupling valves.
- B. Locate quick coupling valves as shown in the Drawings and details.

- C. Locate valve boxes 12 inches from and perpendicular to walk edges, buildings, and walls. Provide 12 inches between other valve boxes where valves are grouped together.

3.11 DRIPLINE AND DRIPLINE COMPONENTS

- A. Thoroughly flush all driplines.
- B. Install dripline a minimum of 12 inches away from all buildings, 6 inches off hardscapes for shrubs and groundcover, and 2 inches of paving for all no-mow or sod type grasses.
- C. Space driplines equally throughout the planting area as detailed. Refer to legend for emitter and row spacing of dripline. Adjust alternate rows so emitters are spaced in a triangular pattern.
- D. All dripline tubing shall be buried 4 inches below finish grade and stapled down every 4 inches and at each change in direction with a 6-inch tubing stake.
- E. For slopes greater than 10:1, modify dripline row spacing on the bottom 1/3 of the slope to be 25 percent greater at the bottom of the slope.
- F. Install flush valves at the low end of each drip zone minimum of 2 valves are required for each valve. Refer to manufacturer details for installation instructions.
- G. Install air vacuum relief valve(s) at high point(s) of each planting area. Refer to Drawings for approximate locations. Revise locations in field based on actual grades of the site. Locate 1 valve per every 500 feet of dripline. Refer to manufacturer details for installation instructions.
- H. Thoroughly saturate soil prior to planting. Provide additional surface watering as required to keep plant root systems moist during planting establishment period.

3.12 BACKFILLING

- A. Backfill only after piping and wire has been inspected and approved.
- B. Backfill material shall be the earth excavated from the trenches, free from rocks, concrete chunks, and other foreign or coarse materials.
- C. Place backfill materials in 6-inch layers and compact by jetting or tamping to a minimum compaction of 90 percent of original soil density.
- D. Dress off areas to finish grade and remove excess soil, rocks, or debris remaining after backfill is completed.
- E. If settlement occurs along trenches, and adjustments in pipes, valves, and sprinkler heads, soil, sod, or paving are necessary to bring the system, soil, sod, or paving to the proper level or the permanent grade, the Contractor, as part of the work under this Contract, shall make all adjustments without extra cost to the Project Representative.

3.13 FIELD QUALITY CONTROL

- A. Coverage Tests
 - 1. Perform coverage tests in the presence of Project Representative, after sprinkler or drip system is completed. Test system to assure that all areas are irrigated completely and uniformly.

2. Do not spray onto pavement or structures. Adjust arc nozzles as needed to provide full coverage without over spray.
- B. Adjusting and Cleaning
1. System Adjustment
 - a. Valves: Adjust flow for proper operation.
 - b. Heads: Adjust for alignment and coverage.
 - c. If it is determined that coverage could be improved by adding additional driplines or a nozzle change, make such changes as required to provide adequate coverage to all plant material.
 - d. Perform final cleaning of all risers, dripline, heads, and equipment for proper operation. Demonstrate operation and uniform coverage in the presence of the Project Representative prior before final acceptance.

3.14 TESTING

- A. General
1. Notify the Project Representative at least three (3) days in advance of testing.
 2. Furnish all necessary testing equipment and personnel.
 3. Perform testing at his/her's own expense.
 4. Correct all leaks and retest until acceptance by the Project Representative.
 5. Center load piping with small amount of backfill to prevent arching or slipping under pressure. No fitting shall be covered.
- B. Closing Uninspected Work: Do not allow or cause any of the work of this Section to be covered up or enclosed until it has been inspected, tested, and approved by the Project Representative and other authorized agencies.
- C. Flushing: Before backfilling the main line, and with all control valves in place but before lateral pipes are connected, completely flush and test the main line and repair all leaks. Flush out each section of lateral pipe before sprinkler heads are attached.
- D. Perform test as specified below. Remake any faulty joints with all new materials. Use of cement or caulking to seal leaks is absolutely prohibited.
- E. Pressure Testing Procedure: Apply the following tests after welded plastic pipe joints have cured at least twenty four (24) hours.
1. Solvent Weld Mainline: Remove all the air from the piping system then test live (constant pressure) and QCV lines hydrostatically at 125 PSI minimum. Lines will be approved if test pressure is maintained for six (6) hours. The lines shall be restored to the original test pressure. The Contractor shall make tests and repairs as necessary until test conditions are met.
 2. Test RCV controlled lateral lines with water at line pressure and visually inspect for leaks. Retest after correcting defects.
- F. Final Inspection
1. Thoroughly clean, adjust, and balance all systems.
 2. Demonstrate the entire system to the Irrigation Consultant and/or, if required, authorized agent and other governing agencies providing that all remote control valves are properly balanced, that all heads are properly adjusted for radius and arc of coverage, and that the installed system is workable, clean, and sufficient.

3.15 GUARANTEE

- A. It shall be the responsibility of the Contractor to fill and repair all depressions and replace all necessary lawn and planting due to the settlement of irrigation trenches for one year following completion and acceptance of the job.
- B. The Contractor shall also guarantee all materials, equipment, and workmanship furnished by him to be free of all defects of workmanship and materials, and shall agree to replace at his expense, at any time within one year after installation is accepted, any and all defective parts that may be found.

3.16 MAINTENANCE

- A. Continuously maintain irrigation system in areas indicated in the Contract during the progress of work and for a period of 90 days after substantial completion.
- B. It is Contractor's responsibility to turn over the irrigation in a first-class condition at the end of the maintenance period.
- C. Maintenance Schedule: Contractor shall submit schedule of maintenance tasks to be performed for Project Representative review and approval. At a minimum, maintenance staff shall be on-site two times per month. It is not the intention of these Specifications to allow a "quick cleanup" at the end of the maintenance period, but rather that the work be continuous and ongoing.
- D. Proper irrigation system maintenance includes the overall supervision of the system, controller scheduling, routine adjustments, and necessary repairs.
- E. Maintain irrigation system for optimum performance, as per manufacturer's specifications, by inspecting the entire system on an on-going basis. This includes cleaning and adjusting all bubbler heads, dripline, and valves for proper coverage.

3.17 CLEAN-UP

- A. Preservation and Cleaning: The Contractor shall clean up the work as it progresses. At frequent intervals, and at all times when directed by the Project Representative, the Contractor shall remove and dispose of accumulations of rubbish and debris of all kinds. At the time of completion, the entire site shall be cleared of tools, equipment, rubbish, etc., all of which shall be removed from the site; and the entire project, including surrounding premises, shall be left in proper, clean condition ready for acceptance.

END OF SECTION

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SECTION 32 90 00**PLANTING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Requirements of Contractor for design-build work, where specified and identified in the various Sections of the Specifications that are part of the Project scope, including the following:
 - 1. Furnish all labor, tools, equipment, materials, and transportation and perform all operations necessary and incidental to proper execution and completion of all planting work in accordance with the Drawings and Specifications.
 - 2. Any items not specifically shown in the Drawings or called for in the Specifications, but normally required to conform with such intent, are to be considered as part of the work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- C. Related Section
 - 1. Section 32 80 00 - Irrigation - Alternate #5: Provision of irrigation.

1.02 SYSTEM DESCRIPTION

- A. Perform work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting, and installing materials.

1.03 SUBMITTALS

- A. Product Data
 - 1. Furnish electronic copies of manufacturers' literature or laboratory analytical data or photographs as appropriate for the following items:
 - a. Existing site topsoil.
 - b. Imported topsoil.
 - c. Organic amendments.
 - d. Organic mulch.
 - e. Inert mulch.
 - f. Erosion control fabric.
 - g. Root barrier.
 - h. Plant material.
 - 2. All submittal data shall be forwarded in a single package to the Architect via the General Contractor within 60 days of award of the General Contract.
- B. Work Schedule: Submit a proposed work schedule to the Architect for approval within 30 days after award of the Contract. After approval, no modification shall be made to this schedule without written authorization by the Architect.
- C. Selection, Tagging, and Ordering of Plant Material
 - 1. Submit documentation to the Architect within 30 days after award of the Contract that all plant materials have been ordered. Arrange procedure for review of plant materials with the Architect at time of submission.

2. Submit color photographs in digital format of each required species and size of plant material as it will be furnished to the project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three (3) photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full botanical name of the plant, container size, and name of the growing nursery.
- D. Certificates of Inspection: Certificates of inspection required by law for transportation shall accompany invoice for each shipment of plants. File copies of certificates with the Architect after acceptance of material. Inspection by Federal or State Governments at place of growth does not preclude rejection of plants at project site.
- E. Maintenance Period: Provide written request to the Architect for review after all planting operations have been completed in accordance with the Contract Documents. Such review is for the purpose of establishing the 1-year maintenance period.

1.04 QUALITY ASSURANCE

- A. Qualifications: The Contractor, personally or through an authorized and competent representative, shall supervise the work constantly, and shall, as far as possible, keep the same foreman and workmen on the job from commencement to completion. The workmanship of the entire job must in every way be first class, and only experienced and competent workmen will be allowed on the job.
- B. All plant materials installed or furnished without prior approval of the Architect may be rejected and the Contractor may be required to remove the equipment or material at their own expense.
- C. Analysis of Samples and Tests: The Architect reserves the right to take and analyze samples of plant materials for conformity to Specifications at any time. Contractor shall furnish samples upon request by the Architect. Rejected materials shall be immediately removed from the site at Contractor's expense. Contractor shall pay cost of testing of materials not meeting Specifications.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Furnish products in manufacturer's standard containers bearing original labels showing quantity, analysis, and name of manufacturer.
- B. Store products with protection from weather or other conditions that would damage or impair the effectiveness of the product.

1.06 COORDINATION

- A. Coordinate and cooperate with other contractors to enable the work to proceed as rapidly and efficiently as possible.

PART 2 - PRODUCTS**2.01 PLANTS**

- A. Base Bid - Hydroseeding: Spray a mixture of seed, mulch, fertilizer, and water—known as a slurry—directly onto prepared soil using a specialized machine (a hydroseeder).
 - 1. Provide meadow mix of 20 native/drought tolerant grasses; 10 shall be selected by the Architect.

2.02 TOPSOIL

- A. General
 - 1. Soil to be used as planting medium for the project shall be fertile, well-drained, of uniform quality, free of stones over 1-inch diameter, sticks, oils, chemicals, plaster, concrete, and other deleterious materials.
 - 2. If soil has been used for agricultural purposes within the prior 12 months, it shall be tested for parasitic nematodes. It shall be acceptable if the parasitic nematode population is less than 200 per 50 cubic centimeters of soil. Soil shall not be artificially dried prior to testing.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Visit site and inspect conditions as they exist prior to submitting bid.

3.02 PROTECTION OF EXISTING PLANTS TO REMAIN

- A. Do not store materials or equipment, permit burning, operate, or park equipment under the branches of any existing plant to remain except as actually required for construction in those areas.
- B. Provide barricades, fences, or other barriers as necessary at the drip line to protect existing plants to remain from damage during construction.
- C. Notify the Architect in any case where Contractor feels grading or other construction called for by Contract Documents may damage existing plants to remain.
- D. If existing plants to remain are damaged during construction, Contractor shall replace such plants of the same species and size as those damaged at no cost to the Owner. Determination of extent of damage and value of damaged plant shall rest with the Landscape Architect.

3.03 SOIL PREPARATION

- A. Soil shall not be worked when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily. Water shall be applied, if necessary, to bring soil to an optimum moisture content for tilling and planting.
- B. All planting areas shall be cleared of stones 2 inches diameter and larger, weeds, debris, and other extraneous materials prior to amending existing soil or spreading stockpiled topsoil.
 - 1. If rock, underground construction work, tree roots, or other obstructions are encountered in the excavation of plant pits, alternate locations may be selected by the Architect. Where locations cannot be changed, submit cost required to remove

the obstructions to a depth of not less than 6 inches below the required pit depth.
Proceed with work after approval of the Architect.

- C. No amending of existing soil shall commence prior to approval by the Architect of soil preparation.

3.04 PLANTING OPERATIONS

- A. Protect plants at all times from sun or drying winds. Plants that cannot be planted immediately upon delivery shall be kept in the shade, well protected, and shall be kept well watered.
- B. Smooth planting areas to conform to specified grades after full settlement has occurred.
- C. Water all plants immediately after planting.

3.05 SURFACE DRAINAGE OF PLANTING AREAS

- A. Test drainage of plant beds and pits by performing percolation tests: Fill pits with water twice in succession. Conditions permitting the retention of water in planting beds for more than twenty-four hours shall be brought to the attention of the Architect. Submit in writing a proposal and cost estimate for the correction to the Architect for approval before proceeding with work.
- B. Contractor shall bear final responsibility for proper surface drainage of planted areas. Any discrepancy in the Drawings or Specifications, obstructions on the site, or prior work done by another party, which Contractor feels precludes establishing proper drainage shall be brought to the attention of the Architect in writing for correction or relief of said responsibility.

3.06 PRESERVATION AND CLEANING

- A. The Contractor shall clean up the work as it progresses. At frequent intervals, and at all times when directed by the Architect, the Contractor shall remove and dispose of accumulations of rubbish and debris of all kinds.
- B. At the time of completion, the entire site shall be cleared of tools, equipment, rubbish, etc., all of which shall be removed from the site; and the entire project, including surrounding premises, shall be left in proper, clean condition ready for acceptance.

3.07 FINAL ACCEPTANCE

- A. Work under this Section will be accepted by the Architect upon satisfactory completion of all work, including maintenance period. Upon final acceptance, the Owner will assume responsibility for maintenance of the work.

END OF SECTION

SECTION 33 10 00**WATER SYSTEM****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Site water distribution system for domestic and fire protection services up to 5 feet of any on-site building being served.
- B. Domestic water and fire protection water transmission or distribution system within a roadway or street right-of-way.

1.02 RELATED SECTIONS

- A. Section 31 21 00, Utility Trenching and Backfill

1.03 RELATED DOCUMENTS

- A. ASME
 - 1. ASME A112.1.2: Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water Connect Receptors)
 - 2. ASME B1.20.1: Pipe Threads, General Purpose, Inch
 - 3. ASME B16.1: Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
 - 4. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings
 - 5. ASME B16.22: Wrought Copper and Copper Alloy Solder – Joint Pressure fittings
 - 6. ASME B16.26: Cast Copper Alloy Fittings for Flared Copper Tubes
- B. ASTM
 - 1. ASTM A536: Standard Specification for Ductile Iron Castings
 - 2. ASTM A674: Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
 - 3. ASTM B61: Standard Specification for Steam or Valve Bronze Castings
 - 4. ASTM B62: Standard Specification for Composition Bronze or Ounce Metal Castings
 - 5. ASTM B88: Standard Specification for Seamless Copper Water Tube
 - 6. ASTM C94: Standard Specification for Ready-Mixed Concrete
 - 7. ASTM D1785: Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 8. ASTM D2564: Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems
 - 9. ASTM F1056: Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings
- C. AWWA
 - 1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
 - 2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
 - 3. C110: Ductile-Iron and Gray-Iron Fittings
 - 4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 - 5. C115: Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
 - 6. C116: Protective Fusion-Bonded Epoxy Coatings for the Interior & Exterior Surfaces for Ductile-Iron and Gray-Iron Fittings
 - 7. C150: Thickness Design of Ductile-Iron Pipe
 - 8. C151: Ductile-Iron Pipe, Centrifugally Cast
 - 9. C153: Ductile-Iron Compact Fittings

10. C200: Steel Water Pipe 6 inch and larger
 11. C203: Coal-Tar Protective Coatings and Linings for Steel Water Pipe
 12. C205: Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 inch and Larger-Shop Applied
 13. C207: Steel Pipe Flanges for Waterworks Service-Sizes 4 inch through 144 inch
 14. C208: Dimensions for Fabricated Steel Water Pipe Fittings
 15. C209: Cold Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings
 16. C210: Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings
 17. C213: Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
 18. C214: Tape Coatings for Steel Water Pipelines
 19. C218: Liquid Coatings for Aboveground Steel Water Pipe and Fittings
 20. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
 21. C500: Metal-Seated Gate Valves for Water Supply Service
 22. C502: Dry-Barrel Fire Hydrants
 23. C503: Wet Barrel Fire Hydrants
 24. C504: Rubber Seated Butterfly Valves.
 25. C507: Ball Valves, 6 inch through 60 inch.
 26. C508: Swing-check Valves for Waterworks Service, 2 inch through 48 inch NPS.
 27. C509: Resilient-Seated Gate Valves for Water Supply Service
 28. C510: Double Check Valve Backflow Prevention Assembly
 29. C511: Reduced-Pressure Principle Backflow Prevention Assembly
 30. C512: Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
 31. C550: Protective Interior Coatings for Valves and Hydrants
 32. C600: Installation of Ductile-Iron Water Mains and Their Appurtenances
 33. C606: Grooved and Shouldered Joints
 34. C651: Disinfecting Water Mains
 35. C800: Underground Service Line Valves and Fittings
 36. C900: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 60 inch for Water Transmission and Distribution
 37. C901: Polyethylene (PE) Pressure Pipe and Tubing, ½ inch through 3 inch for Water Service
 38. C905: Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch through 48 inch for Water Transmission and Distribution
 39. C906: Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 65 inch, for Waterworks
 40. M11: Steel Pipe - A Guide for Design and Installation
 41. M23: PVC Pipe – Design and Installation
 42. M41: Ductile-Iron Pipe and Fittings
- D. Factory Mutual Insurance Company (FM)
1. FM 1530: Fire Department Connections
- E. National Fire Protection Association (NFPA)
1. NFPA 24: Installation of Private Fire Service Mains and Their Appurtenances
 2. NFPA 70: National Electric Code
 3. NFPA 1963: Fire Hose Connection
- F. National Sanitation Foundation (NSF)
1. NSF 61: Drinking Water System Components-Health Effects
- G. Underwriters Laboratory(UL)
1. UL 262: Safety Gate Valves for Fire-Protection Service
 2. UL 405: Safety Fire Department Connection Devices

3. UL 789: Indicator Posts for Fire-Protection Service

1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing Materials
- C. AWWA: American Waterworks Association
- D. DI: Ductile iron
- E. DIP: Ductile iron pipe
- F. FM: Factory Mutual
- G. NFPA: National Fire Protection Association
- H. NSF: National Sanitation Foundation
- I. PCC: Portland cement concrete
- J. PE: Polyethylene
- K. PVC: Polyvinyl Chloride
- L. UL: Underwriters Laboratory

1.05 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working Internal Pressures: As indicated on Plans. [Check if it is indicated on the plans, if not state it here.]
- B. External Load: Earth load indicated by depth of cover plus AASHTO H20 live load unless indicated otherwise.

1.06 SUBMITTALS

- A. Follow submittal procedure outlined in Section 01 10 00, Supplemental General Requirements.
- B. Product Data: Manufacturer's literature and data, including, where applicable, sizes, pressure rating, rated capacity, listing/approval stamps, labels, or other marking on equipment made to the specified standards for materials, and settings of selected models, for the following: *[delete items not included in project]*
 - 1. Piping materials and fittings
 - 2. Gaskets, couplings, sleeves, and assembly bolts and nuts
 - 3. Flexible pipe fittings
 - 4. Restrained pipe fittings
 - 5. Flexible Connectors
 - 6. Expansion joints
 - 7. Flexible expansion joints
 - 8. High deflection fittings/ball joints
 - 9. Gate valves

10. Butterfly valves
 11. Check valves
 12. Ball valves
 13. Air release, air/ vacuum and combination air valves
 14. Blow-off valves
 15. Pressure reducing valves
 16. Flow Regulating valves
 17. Service connections and water meters
 18. Valve boxes, meter boxes, frames and covers
 19. Backflow preventers
 20. Fire hydrants
 21. Post indicator valves
 22. Fire department connections
 23. Thrust block concrete mix
 24. Tapping sleeves and tapping valves
 25. Service saddles and corporation stops
 26. Identification materials and devices
- C. Shop Plans and Calculations: Where an on-site fire water system is required, Contractor shall provide shop plans for Engineer and agency approval prior to construction. Coordinate with the Plans and identify any proposed modifications or deviations. Shop Plans and Calculations shall be stamped and signed by a registered Fire Protection Engineer licensed by the State of California as required.
1. Include the following information:
 - a. Design assumptions
 - b. Thrust block sizing and calculations
 - c. Materials to be used
 - d. Available water pressure
 - e. Required water pressure
 2. The review of fire system components constitutes only a portion of the review and approval required. A copy of the fire system component submittal package shall be forwarded to the local fire marshal for further review and approval.
- D. Water Pressure Report: At the conclusion of work, the Contractor shall engage a qualified testing service to conduct a flow test of the existing system (providing flow test data for all mains and at least six (6) hydrants). Provide date and location of test, type and method of test performed, static pressure and residual pressure in psig, observed flow in gpm, and orifice size.
- E. Shop drawings: Include plans, elevations, details and attachments.
1. Precast and cast in-place vaults and covers
 2. Wiring diagrams for alarm devices
- F. Field test reports: Indicate and interpret test results for compliance with the Project requirements.

1.07 QUALITY ASSURANCE

- A. Comply with requirements of utility supplying water. Do not operate existing valves or tap existing piping without written permission and/or presence of utility company representative.
- B. Comply with the following requirements and standards:
1. NSF 61: "Drinking Water System Components-Health Effects" for materials for potable water.

2. NFPA 24: "Installation of Private Fire Service Mains and Their Appurtenances" for materials, installations, tests, flushing, and valve and hydrant supervision.
 3. NFPA 70: "National Electric Code" for electrical connections between wiring and electrically operated devices.
- C. Provide listing/approval stamp, label, or other marking on piping and specialties made to a specified standard.

1.08 MATERIAL 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. 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.
- C. Handling: Use slings to handle valves and fire hydrants whose 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. 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. Protection from Weather: Store indoors and maintain temperature higher than ambient dew-point temperature. 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.
- E. Do not store plastic pipe and fittings in direct sunlight.
- F. Protect pipe, fittings, flanges, seals and specialties from moisture, dirt and damage.
- G. Protect linings and coatings from damage.
- H. Handle precast boxes, vaults and other precast structures according to manufacturer's written instructions.
- I. Protect imported bedding and backfill material from contamination by other materials.

1.09 COORDINATION

- A. Coordinate connection to existing water mains with water utility supplying water.
- B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building domestic water distribution piping and fire protection piping.

PART 2 - PRODUCTS**2.01 PVC PIPE: SIZES 1/8 INCH THROUGH 3 INCH**

- A. Pipe and Fittings: ASTM D1785, Schedule 40. [Schedule 80 and 120 are also available. Pressure ratings up to 260 psi are achievable with schedule 40]
- B. Joints: Restrain with solvent cement. Do not use threaded pipe.
- C. Solvent Cement: ASTM D2564.

2.02 PVC PIPE: SIZES 4 INCH THROUGH 48 INCH

- A. Pipe: Pressure Class 200, DR 14, spigot and gasket bell end, conforming to AWWA C900 (4 inch through 12 inch and AWWA C905 (14 inch through 48 inch)
- B. Fittings: Ductile iron fittings
 - 1. Standard: AWWA C110, sizes 4 inch through 48 inch
 - 2. Compact: AWWA C153, sizes 4 inch through 24 inch
 - 3. All fittings shall be fusion epoxy coated per AWWA C116
- C. Unrestrained Joints: Push-On Bell and Spigot Joint: AWWA C900
- D. Restrained Joints:
 - 1. Push-On Bell and Spigot Joint: Harness assembly as manufactured by EBAA Iron, or approved equal. [Check with the manufacturer for sizes, pressure ratings and corrosion protection coatings that are available.]
 - 2. Plain End PVC to Ductile Iron Mechanical Joint: EBAA Iron, or approved equal.
- E. Steel or Ductile Iron Couplings: [check with manufacturer for sizes and pressure rating available]
 - 1. Plain End Pipe to Plain End Pipe: Ductile iron or steel bolted couplings, manufacturer's shop coating with low alloy steel bolts and nuts. Steel couplings to conform to AWWA C219. Smith-Blair, Inc., Dresser, or approved equal.
 - 2. Plain End Pipe to Ductile Iron or Steel Flanged Pipe: Ductile iron or steel bolted flanged coupling adapters, manufacturer's shop coating with low alloy steel bolts and nuts. Steel flanged couplings to conform to AWWA C219. Smith-Blair, Inc, Dresser or approved equal.
- F. PVC Couplings: [check with manufacturer for sizes and pressure rating available]
 - 1. Unrestrained Plain End to Plain End Pipe: AWWA C900, as manufactured by North American Piper approved equal
 - 2. Restrained Plain End to Plain End Pipe: AWWA C900, "Fluid-Tite" as manufactured by North American Pipe, or approved equal.

2.03 FLEXIBLE CONNECTORS

- A. Flanged Coupling Adapters for plain end pipe at fittings, valves and equipment shall be Dresser Style 127 or 128, similar models by ITT; Baker Coupling Company or approved equal. Nuts, bolts and other hardware shall be Type 304 stainless steel.
- B. Mechanical Couplings shall be rated for a minimum working pressure of 150 psi. The barrel shall be a minimum 10 inches long. Couplings shall be cleaned and shop primed with

manufacturer's standard rust inhibitive primer. Mechanical couplings shall be Smith-Blair, Romac, JCM, Apac or approved equal, with stainless steel nuts, bolts, and threaded rods.

- C. Flexible Coupling for Steel Pipe shall be Dresser Coupling Style 38 with EPDM gaskets, or approved equal.

2.04 EXPANSION JOINT [CHECK WITH THE MANUFACTURER TO DETERMINE THE PIPE MATERIALS TO WHICH THE FOLLOWING FITTINGS MAY BE JOINED.]

- A. An expansion joint shall be installed at location indicated on the Plans and shall be manufactured of ductile iron conforming to the material properties of AWWA C153.
- B. Separation beyond the maximum extension of the expansion joint shall be prevented without the use of external tie rods.
- C. The expansion joint shall be pressure tested against its own restraint to a minimum of 250 psi.
- D. All pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy, conforming to the applicable requirements of AWWA C213, and shall be tested with a 1500 volt spark test conforming to stated specification.
- E. Mechanical or Flanged Joint: The expansion joint shall be Model Ex-Tend 200, 4 inch through 36 inch, as manufactured by EBAA Iron, Inc., or approved equal.
- F. TR Flex Joints: TR Flex Telescoping Sleeve, 4 inch through 64 inch, U. S. Pipe.

2.05 FLEXIBLE EXPANSION JOINTS

- A. Flexible expansion joints shall be installed at locations indicated on the Plans and shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and AWWA C153.
- B. Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum of 250 psi. A minimum 2:1 safety factor, determined from the published pressure rating, shall apply.
- C. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of 15°, and 6 inches minimum expansion. The flexible expansion fitting shall not expand or exert an axial imparting thrust under internal water pressure. The flexible expansion fitting shall not increase or decrease the internal water volume as the unit expands or contracts.
- D. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet ANSI/NSF-61.
- E. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C116
- F. Polyethylene sleeves, meeting AWWA C105, shall be included for direct buried applications.
- G. Flanged or mechanical Joint: Flexible expansion joint shall be Force Balanced FLEX-TEND, sizes 3 inch through 48 inch, as manufactured by EBAA Iron, or approved equal.

- H. Flanged Joint: Starflex, Series 5000, Star Pipe Products, or approved equal.
- I. Plain End to Plain End Pipe: "Xtra Flex," sizes 4 inch through 24 inch, U. S. Pipe, or approved equal.

2.06 HIGH DEFLECTION FITTINGS/BALL JOINTS

- A. Plain End Pipe: Xtra Flex Restrained Joint High Deflection Fittings, 4 inch through 24 inch, U. S. Pipe, or approved equal.
- B. Mechanical or Flanged Joint: Flex 900, 4 inch through 12 inch, EBAA Iron, or approved equal.

2.07 GATE VALVES [PROVIDE ON PIPES 12 INCH AND SMALLER]

- A. Provide valves conforming to AWWA C500 or AWWA C509
- B. Valves shall be resilient-seated, with non-rising stem, gray or ductile-iron body and bonnet, with bronze or gray or ductile-iron gate, bronze stem and square stem operating nut unless noted otherwise.
- C. [Metal seated, AWWA C500, and rubber seated, AWWA C504, are also available.]
- D. All bolts, nuts and washers, except operating nut, shall be stainless steel.
- E. Stem operating nut to be 2 inches square and open counter-clockwise.
- F. Stem extensions shall be installed to bring the stem operating nut to within 2 feet of finish grade where the depth from finish grade to the stem operating nut exceeds 4 feet.
- G. Equip valves in pump stations and other interior or vault installations with hand-wheels.
- H. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.
- I. For the domestic water system, valves shall also conform to NSF 61.
- J. Service valve Valves and fittings, 2 inch and smaller shall be in accordance with AWWA C800
- K. Where a post indicator is shown, provide valve with an indicator post flange.
- L. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
 - 1. Mueller Company
 - 2. M&H Valve Company
 - 3. Crane Company, or approved equal

2.08 BUTTERFLY VALVES [PROVIDE ON PIPES LARGER THAN 12 INCH]

- A. AWWA C504, rubber seated, Class 150B cast iron body, cast or ductile iron discs, stainless steel shafts, adjustable field replaceable rubber seats mating against stainless steel seat rings and field-replaceable seals.
- B. Flanged or mechanical joint end connections.

- C. No wafer type valves allowed.
- D. Traveling nut type valve actuators designed for buried service unless noted otherwise.
- E. All bolts, nuts and washers, except wrench nut, shall be stainless steel.
- F. Wrench nut to be 2 inches square and open counter-clockwise.
- G. Stem extensions shall be installed to bring the wrench nut to within 2 feet of finish grade where the depth from finish grade to the wrench nut exceeds 4 feet.
- H. Equip valves in pump stations and other interior or vault installations with hand-wheels.
- I. Provide protective epoxy interior and exterior coating according to AWWA C550 and manufacturer's recommendations.
- J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Mueller Company
 - 2. M&H Valve Company
 - 3. Crane Company, or approved equal

2.09 SWING CHECK VALVES

- A. Provide swing-check type valves conforming to AWWA C508.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Mueller Company
 - 2. M&H Valve Company
 - 3. DeZurik/APCO
 - 4. Watts, or approved equal

2.10 BALL VALVES

- A. Provide ball valves (6 inch through 48 inch) per AWWA C507 as manufactured by Crane Company, or approved equal.
- B. Provide ball valves (2 inches and smaller) conforming to AWWA C800 as manufactured by Mueller 300 Series, Ford, or approved equal.
- C. Valves shall open by counterclockwise rotation of the valve stem.
- D. Provide valves with ends as appropriate for the adjoining pipe.
- E. Provide valve with lockable operating nut or handle as shown on the Plans.

2.11 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES

- A. Air release and vacuum valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve body, and shall conform to AWWA C512. A compound lever system shall have a maximum operating pressure of 300 psi. Provide a

protective cap for the outlet of the valve. Provide universal air-vacuum type valves, Crispin, DeZurik/APCO or approved equal.

- B. Combination air valves: Provide valve and service size as shown on the Plans. Valve shall have cast-iron single valve or double valve body, and shall conform to AWWA C512. A simple or compound lever system shall have a maximum operating pressure of 300 psi. Provide a protective cap for the outlet of the valve.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the project include, but are not limited to, the following:
 - 1. Crispin
 - 2. DeZurik/APCO, or approved equal

2.12 BLOW-OFF VALVES

- A. Provide valve and service size as shown in the Plans. Provide 2 inch valves at low points of the piping system, and 4 inch valves at dead-ends of the piping system, unless otherwise directed by the Engineer.
- B. 2 inch blow-off shall have a 2 inch vertical female iron pipe (FIP) inlet and a 2 inch normal pressure and temperature (NPT) nozzle outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16 inch square operating nut. All working parts shall be serviceable without excavation. Kupferle/Truflo Model TF550, or approved equal.
- C. 4 inch blow-off shall have all brass principal working parts, 4 inch inlet and outlet and is self-draining and non-freezing. Valve shall open by counterclockwise rotation of a top-mounted 2 inch square operating nut. All working parts shall be serviceable without excavation.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
- E. Kupferle/ MainGuard #7600, or approved equal

2.13 PRESSURE-REDUCING VALVES

- A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250 psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment.
- B. Valves shall have flanged ends. Valves sized 3 inches or smaller may have screwed ends.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Cla-Val Company
 - 2. Bermad
 - 3. Ames Company, or approved equal

2.14 FLOW-REGULATING VALVES

- A. Valve: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. 250 psi working-pressure, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment. Details as indicated.

- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Cla-Val Company
 2. Bermad
 3. Ames Company, or approved equal

2.15 SERVICE CONNECTIONS AND WATER METERS

- A. Service connections and water meter details and boxes as indicated.

2.16 VALVE BOXES, METER BOXES, FRAMES AND COVERS

- A. Water Valve Box: Provide pre-cast concrete valve box for each buried valve. Provide box with steel or cast iron traffic cover marked "WATER". Christy Model G5 with G5C cover or approved equal.
- B. Valve or Meter Boxes: Contractor shall verify box size required for water system appurtenances as shown in the Construction Documents. Provide a precast concrete utility box for each buried appurtenance. Provide a traffic-rated lid for H20 loading. A non-traffic rated lid may be used for boxes located in landscape areas. Christy, or approved equal.

2.17 BACKFLOW PREVENTER - REDUCED PRESSURE PRINCIPLE ASSEMBLIES (RPPA)

- A. Provide RPPA consisting of two independently operating check valves with a pressure differential relief valve located between the two check valves, two shut-off valves and four test cocks. RPPA shall be tamper-proof and conform to AWWA C511. Valve shall have an outside screw (OS) gate valve on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves for continuous-pressure application.
- B. Body:
1. 2 inch and Smaller: Bronze with threaded ends
 2. 2 ½ inch and Larger: Bronze, cast iron steel, or stainless steel with flanged ends
- C. Interior Lining: AWWA C550, epoxy coating for cast iron or steel bodies
- D. Interior Components: Corrosion-resistant materials
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
1. Cla-Val Company
 2. Ames Company
 3. Febco, CMB Industries, Inc.
 4. Hersey Products, Inc.
 5. Watts
 6. Zurn/Wilkins, or approved equal

2.18 THRUST BLOCKS

- A. Use concrete conforming to ASTM C94 having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 ½ parts sand, and 5 parts gravel, having the same minimum compressive strength.

- B. Provide thrust blocks or mechanical pipe restraints at all fittings and changes in angle, alignment or elevation.
- C. Where depth or location of existing structures prohibit the use of standard thrust blocks, gravity blocks may be used.

2.19 TAPPING SLEEVES AND TAPPING VALVES

- A. Tapping sleeves shall be epoxy coated and furnished with stainless steel washers, nuts and bolts. Mueller H-615 and H-619, Ford, or approved equal.
- B. Tapping valves shall have flanged inlet, Class 125, conforming to ASME B16.1 and furnished with stainless steel washers, nuts and bolts. Tapping valves shall be constructed with a mechanical joint outlet. Mueller T-687, T-642, T-681, or approved equal.

2.20 SERVICE SADDLES AND CORPORATION STOPS

- A. Service Saddles: Saddles shall conform to AWWA C800 and NSF 61.
 - 1. For DIP: Provide bronze or stainless steel body, double strap type with a 200 psi, maximum working pressure. Mueller BR2 Series, Ford, or approved equal.
 - 2. For PVC: Provide bronze body, wide strap type. Mueller H-13000 Series, Ford, or approved equal.
 - 3. For PE: Per manufacturer's recommendations.
- B. Corporation Stops: Provide ground key type; bronze conforming to ASTM B61 or ASTM B62, for a working pressure of 100 psi and suitable for the working pressure of the system.
 - 1. Ends shall be suitable for adjoining pipe and connections, solder-joint, or flared tube compression type joint.
 - 2. Threaded ends shall conform to AWWA C800.
 - 3. Coupling nut for connection to flared copper tubing shall conform to ASME B16.26.
 - 4. Mueller H-15000 Series with "CC" threads and a copper flare straight connection outlet, Ford, or approved equal.

2.21 IDENTIFICATION MATERIALS AND DEVICES

- A. Warning Tape: Provide warning tape consisting of metallic foil bonded to solid blue plastic film not less than 3 inches wide. Film shall be inert polyethylene plastic. Film and foil shall each not be less than 1 mil thick. The tape continuously shall have printed black-letter, not less than 3/4 inch high, message reading "CAUTION: WATER MAIN BELOW".
- B. Tracer Wire for Nonmetallic Piping: Provide 12 guage, coated copper or aluminum wire not less than 0.10 inch in diameter, with blue THW, THWN, or THHN rated insulation, in sufficient length to be continuous over each separate run of nonmetallic pipe. Wire shall be tied in at all valves.

PART 3 - EXECUTION

3.01 PIPE INSTALLATION

- A. Pipe Depth and Trench Configuration: Conform to elevations, profiles and typical trench section(s) shown on the Plans.
- B. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00 – Utility Trenching and Backfill.

- C. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.
- D. Pipe laying and jointing:
1. Provide proper facilities for lowering sections of pipe into trenches.
 2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.
 3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
 4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
 5. Grade the pipeline in straight lines; avoid the formation of dips and low points.
 6. Support pipe at proper elevation and grade.
 7. Provide secure firm, uniform support. Wood support blocking will not be permitted.
 8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
 9. Provide anchors and supports where indicated and where necessary for fastening work into place.
 10. Make proper provision for expansion and contraction of pipelines.
 11. Keep trenches free of water until joints have been properly made.
 12. Do not lay pipe when conditions of trench or weather prevent proper installation.
 13. All fittings shall be blocked with appropriately sized thrust blocks as shown on the Plans.
- E. Installation of Tracer Wire:
1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
 2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
 3. Form a mechanically and electrically continuous line throughout the pipeline, extending to the nearest valve or other pipeline appurtenance. Extend the wire up the outside of the valve box/riser and cut a hole that is 8 inches from the top, extend a 12 inch wire lead to the inside of the box. At other pipeline appurtenances, terminate the 12 inch wire lead inside the enclosure.
 4. Splice wire with a splicing device consisting of and electro-tin plated seamless copper sleeve conductor. Install as recommended by the manufacturer. Wrap splices and damaged insulation with electrician's tape.
- F. Installation of Warning Tape
1. Install tape approximately 1 foot above and along the centerline of the pipe.
 2. Where tape is not continuous, lap tape ends a minimum of 2 feet.
- G. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. If necessary, use shorter than the standard lengths of pipe to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- H. Connections to Existing Lines:
1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
 2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.

- I. Closure: Close open ends of pipes and appurtenance openings at the end of each day's work or when work is not in progress.

3.02 INSTALLATION OF POLYVINYL CHLORIDE PIPING

- A. Comply with the recommendations for pipe installation, joint assembly and appurtenance installation in AWWA Manual M23.
- B. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.
- C. Jointing:
 1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
 2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
 3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
 4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
 5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the applicable requirements of AWWA C600 for joint assembly.
 6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
 7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.
- D. Pipe Anchorage:
 1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Plans.

3.03 INSTALLATION OF VALVES

- A. Gate Valves
 1. Install gate valves conforming to AWWA C500 and UL 262 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, operation, and Maintenance of Gate Valves) to AWWA C509.
 2. Install gate valves conforming to AWWA C509 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C509.
 3. Install gate valves on PVC water mains in addition in accordance with the recommendations for appurtenance installation in AWWA Manual M23.
- B. Butterfly Valves: Install butterfly valves in accordance with the applicable requirements of Appendix A of AWWA C504.
- C. Check Valves: Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated.
- D. Joints:
 1. Valves on DI, PE and PVC Pipe: Mechanical joint valves for buried locations. Flanged-end valves for installation in vaults/pits.

2. Valves on Steel Pipe: As indicated for buried locations. Flanged-end valves for installation in vaults/pits.

3.04 INSTALLATION OF VALVE AND METER BOXES

- A. Boxes shall be centered over the appurtenance so as not to transmit shock or stress. Covers shall be set flush with the surface of the finished pavement, or as shown on the Plans. Backfill shall be placed around the boxes and compacted to the specified level in a manner that will not damage or displace the box from proper alignment or grade. Misaligned boxes shall be excavated, plumbed, and backfilled at no additional cost to the Owner.

3.05 SERVICE LINE CONNECTIONS TO WATER MAINS

- A. Connect service lines of size shown on plans to the main with a rigid connection or a corporation stop and gooseneck. Install a gate valve on the service line.
- B. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.
- C. Connect service lines to PVC plastic water mains in accordance with the recommendations of AWWA Manual M23.

3.06 INSTALLATION OF BACKFLOW PREVENTERS

- A. Backflow devices shall be installed horizontal and level, with three feet minimum clearances from obstructions.

3.07 ANCHORAGE INSTALLATION

- A. Mechanically Restrained Joints: Install where indicated for lengths indicated in accordance with manufacturer's instructions.
- B. PCC Thrust Blocks: Install where required and as indicated. Bearing area indicated is to be against undisturbed earth. Allow a minimum of 24 hours curing time before introducing water into the pipeline and allow a minimum of 7 days curing time before pressure testing.

3.08 CONNECTION TO EXISTING

- A. Contractor shall submit a work plan delineating the work sequence and duration of each task.
- B. The Contractor to submit a contingency plan in case work extends beyond the allowable shutdown duration
- C. Contractor to notify Owner 48 hours prior to shutdown.
- D. Prior to shutdown the Contractor shall have the following:
 1. Approved submittals for the work to be done
 2. Approved work plan
 3. Approved contingency plan
 4. The material, tools and equipment necessary to do the work, including pumps, generator, lighting, etc.
- E. No work shall be done within two weeks from a wet weather event.

- F. Contractor to check the weather (NOAA website) and plan work during dry weather period.

3.09 HYDROSTATIC PRESSURE AND LEAKAGE TEST

A. General:

1. Provide all necessary materials and equipment, including water.
2. Backfill all trenches sufficient to hold pipe firmly in position.
3. Allow time for thrust blocks to cure prior to testing.
4. Flush all pipes prior to testing to remove all foreign material.
5. Perform pressure and leakage test concurrently.
6. Apply test pressure by means of a pump connected to the pipe.
7. Base test pressure on the elevation of the lowest point in the line.
8. Fill each closed valve section or bulk-headed section slowly. Expel air from section being tested by means of permanent air vents installed at high points or by means of temporary corporation cocks installed at such points. Remove and plug the temporary corporation cocks at the conclusion of the test.
9. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.
10. The pressure test on mortar-lined pipe shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption in the cement mortar lining.
11. Allow the system to stabilize at the test pressure before conducting the leakage test.
12. Do not operate valves in either the opening or closing direction at differential pressures above the valves rated pressure.
13. Maintain test pressure as specified for type of pipe being tested.
14. Pressure Test: Examine any exposed pipe, fittings, valves, hydrants and joints during the test, if no leaks are observed the section of line has passed the pressure test. If leaks are observed, repair any damaged or defective pipe, fittings, valves, or hydrants, and repeat the pressure test.
15. Leakage Test: Perform as specified hereafter for the type of pipe being installed.

B. Preparation for Test

1. Vents shall be provided at the high points of the system and drains provided where means of venting or draining do not exist.
2. Remove or block off, all relief valves, rupture discs, alarms, control instruments, etc. that shall not be subjected to the test pressure.
3. All discs, balls, or pistons from check valves shall be removed if they interfere with filling of the system. Open all valves between inlet and outlet of the section to be tested.
4. Connect pump and provide temporary closures for all of the external openings in the system. Use caution to insure that the closures are properly designed and strong enough to withstand the test pressure.
5. A joint previously tested in accordance with this specification may be covered or insulated.
6. Expansion joints shall be provided with temporary restraint for additional pressure under test or shall be isolated from the test.
7. Flanged joints, where blanks are inserted to isolate equipment during the test, need not be tested.

C. DIP Leakage Test: Perform in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated as follows:

1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
3. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (S \times D \times P^{1/2}) / 133,200$$

L = Allowable leakage, gallons per hour.

S = Length of pipe tested, feet.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

D. PE Pipe Leakage Test:

1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
2. Apply the test pressure and allow the pipe to stand, without makeup pressure, for sufficient time to allow for diametric expansion or pipe stretching to stabilize, approximately two to three hours.
3. After the above stabilization has occurred, return the section being tested to the test pressure. Hold the test pressure for four hours. If the pressure in the test section drops, and it is determined the drop may be the result of expansion resulting from increasing temperature, a limited amount of additional water may be added to bring the pressure back to the test pressure. Allowable amounts of make-up water, to compensate for expansion due to increasing temperature, are as shown in the following table. Make-up water is only allowed during this final test period and not during the initial stabilization described in the previous paragraph. If the additional water added is less than the allowable shown in the table and there are no visual leaks or significant pressure drops, the tested section passes the test.

Nominal Pipe Size (in.) Test	Allowance for Expansion (U.S. Gals./100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.50
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

E. PVC Pipe Leakage Test: Perform in accordance with AWWA M23. Selected requirements of AWWA M23 are repeated as follows:

1. The pipe shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure, or 150 psi, whichever is greater. In no case shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.

2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
3. No piping will be accepted if the leakage is greater than that determined by the following formula:

$$L = (N \times D \times P^{1/2}) / 7,400$$

L = Allowable leakage, gallons per hour.

N = Number of joints in the length of the pipeline tested.

D = Nominal diameter of pipe, inches.

P = Average test pressure during the leakage test, pounds per square inch (gauge).

- F. Cement Mortar Lined and Coated Steel Pipe Leakage Test: Perform in accordance with AWWA M11. Selected requirements of AWWA M11 are repeated as follows:
1. All pipelines shall be tested by subjecting each section to a pressure, measured at the lowest end of the section, of at least 150 percent of the class rating or design pressure of the pipe under test. In no case shall the pipe be tested at less than 150 psi, nor shall the pressure be allowed to exceed the design pressure for pipe, appurtenances, or thrust restraints.
 2. Maintain the test pressure, +/- 5 psi, for a minimum of four hours.
 3. There shall be no significant leakage for pipe with welded joints or mechanical couplings.
 4. For pipe joined with O-ring rubber gaskets, a leakage of 25 gallons per inch of diameter per mile per 24 hours is allowed.

3.10 CLEANING

- A. At the conclusion of the work, thoroughly clean all pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Owner will examine the pipes for leaks. If any further defective pipes or joints are discovered, the Contractor shall repair them. Finished paving shall not be installed prior to completion of all cleaning and testing.

3.11 DISINFECTION OF PIPELINES

- A. After completion of the hydrostatic test, the mains shall be thoroughly flushed with a minimum pipe velocity of 2.5 fps and chlorinated in accordance with the latest revision of AWWA 651, Standards of Disinfecting Water Mains. Any one of the methods therein described may be used, with the additional requirement of 50 ppm chlorination minimum initial application. At the end of the contact period, the mains shall again be flushed, and bacteriological samples taken.
- B. If necessary, the Contractor shall provide, at his expense, outlets from which to take the samples. The location of the chlorination and sampling points will be determined by the Owner in the field. Taps for chlorination and sampling shall be installed. The Contractor shall uncover and backfill the taps as required.
- C. Disinfection of tie-ins shall be performed by the Contractor by swabbing with chlorine or by other approved methods. Following a tie-in, the area affected by the tie-in shall be thoroughly flushed and bacteriological samples will be taken as deemed necessary.

- D. All treated water flushed from the lines shall be dechlorinated and disposed of by discharging to the locations identified in the Plans, or by other approved means. No discharge of chlorinated water to any storm sewer or natural water course will be allowed, unless properly dechlorinated.
- E. The Contractor shall rechlorinate and retest any lines that do not meet the requirements of the above testing. The line shall not be placed in service until the requirements of the State Public Health Department are met.

3.12 BACTERIOLOGICAL TESTING

- A. Samples shall be gathered and tests conducted at the expense of the Contractor by a laboratory approved by the Owner.
- B. Water samples are to be taken at representative points no less than one test per 500 feet of pipe, plus one test at each end of the pipe; or as required by the Owner.
- C. After the samples have passed the bacteriological testing, the Contractor will be notified and arrangements can be made to make tie-ins and connections to house services.
- D. Each water sample will have passed the bacteria tests if they show zero total coliform per 100 ml and not more than 50 non-sheen bacteria per 100 ml, and when the turbidity is no greater than the source water.
- E. Samples shall be taken no sooner than 24 hours after final flushing.
- F. Jumpers and/or plates shall be pulled within 14 days of the notification of a successful test, or new bacteria samples will have to be taken.
- G. Follow-up bacteriological testing shall take place after tie-ins have been made, and shall meet the same passing requirements as the initial tests.

END OF SECTION

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SECTION 33 41 00**STORM UTILITY DRAINAGE PIPING****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Roadway and/or site storm drainage system up to five feet of any on-site building

1.02 RELATED SECTIONS

- A. Section 31 21 00, Utility Trenching and Backfill
- B. Section 32 13 18, Cement and Concrete for Exterior Improvements

1.03 RELATED DOCUMENTS

- A. AASHTO
 - 1. M199: Precast Reinforced Concrete Manhole Sections
 - 2. M252: Corrugated Polyethylene Drainage Pipe
 - 3. M294: Corrugated Polyethylene Pipe, 12 to 604 inch Diameter
- B. ASTM
 - 1. A74: Cast Iron Soil Pipe and Fittings
 - 2. A615: Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 3. C143: Standard Test Method for Slump of Hydraulic-Cement Concrete
 - 4. C443: Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 - 5. C478: Circular Precast Reinforced Concrete Manhole Sections
 - 6. C564: Rubber Gaskets for Cast Iron Soil Pipe and Fittings
 - 7. C923: Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
 - 8. C1173: Flexible Transition Couplings for Underground Piping Systems
 - 9. D1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 10. D2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
 - 11. D2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
 - 12. D3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 13. D4101: Propylene Injection and Extrusion Materials
 - 14. F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - 15. F656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
 - 16. F679: Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
 - 17. F1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings
- C. AWWA
 - 1. C104: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
 - 2. C105: Polyethylene Encasement for Ductile-Iron Pipe Systems
 - 3. C110: Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. for Water
 - 4. C111: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 - 5. C115: Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
 - 6. C116: Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
 - 7. C150: Thickness design of Ductile Iron Pipe

8. C151: Ductile-Iron Pipe, Centrifugally Cast
9. C153: Ductile-Iron Compact Fittings
10. C219: Bolted, Sleeve-type Couplings for Plain-End Pipe
11. M41: Ductile Iron Pipe and Fittings

D. Caltrans Standard Specifications, 2023

1. Section 51, Concrete Structures
2. Section 52, Reinforcement
3. Section 65, Concrete Pipe
4. Section 66, Corrugated Metal Pipe
5. Section 70, Miscellaneous Drainage Facilities
6. Section 72, Slope Protection
7. Section 75, Miscellaneous Metal
8. Section 90, Concrete

E. Caltrans Standard Plans, 2023

1. Plan D94A: Metal and Plastic Flared End Sections
2. Plan D94B: Concrete Flared End Sections
3. Plan D97A: Corrugated Metal Pipe Coupling Details No. 1, Annular Coupling Band Bar and Strap and Angle Connection
4. Plan D97C: Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers
5. Plan D97D: Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands
6. Plan D97E: Corrugated Metal Pipe Coupling Details No. 5, Standard Joint
7. Plan D97F: Corrugated Metal Pipe Coupling Details No. 6, Positive Joint
8. Plan D97G: Corrugated Metal Pipe Coupling Details No. 7, Downdrain
9. Plan D98A: Slotted Corrugated Steel Pipe Drain Details
10. Plan D98B: Slotted Corrugated Steel Pipe Drain Details

1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing Materials
- C. AWWA: American Water Works Association
- D. CMP: Corrugated metal pipe
- E. DIP: Ductile iron pipe
- F. HDPE: High-density polyethylene
- G. NPS: Nominal pipe size
- H. PE: Polyethylene
- I. PVC: Polyvinyl Chloride
- J. RCP: Reinforced concrete pipe

1.05 SUBMITTALS

- A. Product data for the following:

1. Piping materials and fittings
 2. Special pipe couplings
 3. Polymer-concrete, channel drainage systems (trench drains)
 4. Joint sealants
 5. Plastic area drains
 6. Cleanout plugs or caps
 7. Precast concrete catch basins, inlets, curb inlets, junction structures and area drains, including frames and grates
 8. Precast clean out boxes and box covers
 9. Concrete, metal and plastic flared end sections
- B. Shop drawings: Include plans, elevations, details and attachments for the following:
1. Precast concrete manholes, frames and covers
- C. Design Mix Reports and Calculations: For each class of cast in place concrete
- D. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage
1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
 2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- B. Handling
1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.
 2. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.
 3. Protect imported bedding and backfill material from contamination by other materials.

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS-SMALLER THAN 4 INCH

- A. Pipe shall be in accordance to ASTM D1785, Schedule 40. [Check external load and laying condition, schedule 80 and 120 are also available if stronger pipe is required.]
- B. Joints: Solvent Cement, ASTM D2564
- C. Include primer according to ASTM F656
- D. Special Pipe Coupling: ASTM C1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.02 PVC PIPE, 4 INCH AND LARGER

- A. Pipe
 - 1. 4 inch through 15 inch: ASTM D3034, SDR 26
 - 2. 18 inch through 36 inch: ASTM F679, T-1 wall
- B. Bell and spigot joints
- C. Fittings:
 - 1. 4 inch through 27 inch: ASTM F1336
 - 2. 30 inch through 36 inch: ASTM D3034, SDR 35
- D. Joint Gasket: Elastomeric seal, ASTM F477
- E. Special Pipe Coupling: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined

2.03 PIPE ANCHORS

- A. General: Location, configuration bearing area, etc. as indicated
- B. Portland Cement Concrete: Section 32 13 18, Cement and Concrete for Exterior Improvements

2.04 PIPE CLEANOUTS

- A. Piping: Same as storm drain line if possible
- B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.
- C. Box Size: As required to provide access and allow easy removal and reinstallation of cap
- D. Box Types
 - 1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty
 - 2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading
- E. Box Cover Markings: "S.D.," unless otherwise specified
- F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to the following:
 - 1. Associated Concrete Products, Inc.
 - 2. Brooks Products Inc.
 - 3. OldCastle Precast/Christy Concrete Products, Inc.

2.05 AREA DRAINS

- A. Grate and Riser: Area drain shall be as manufactured by Nyloplast or approved equal. Riser shall be constructed of 6 inch PVC SDR 35 piping per paragraph 2.1(A) of this section and connected to area drain by a gasket joint. Riser shall be vertical except as otherwise noted in the plans. Riser may include a reducer if necessary to make connection to the storm drain line.

- B. Elevation and Grading: Area Drain rim elevation shall be set and area around area drain shall be graded to drain away from any adjacent structures, walks, or roadways and towards area drain.

2.06 CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC.

- A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.
- B. Portland Cement Concrete and Reinforcing: Section 32 13 18, Cement and Concrete for Exterior Improvements.
- C. Precast Structure: Rate for AASHTO H20 loading in traffic areas.
- D. Steps: ASTM C 478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, (Milpitas, CA) (Tel 408-262-1091).
- E. Frames, Grates and Covers: Caltrans Standard Specification Section 75-1.02, 75-1.02.B and 75-2
 - 1. Galvanize steel frames, grates and covers
 - 2. Grates and covers shall be non-rocking
 - 3. Rate for AASHTO H20 loading in traffic areas

2.07 MANHOLES

- A. Manholes shall be pre-cast concrete of the size and shape shown on the Plans and shall conform to ASTM C478. Equivalent poured-in-place structures may be used at the Contractor's option. Concrete shall consist of Caltrans Type I/II cement. Rate for AASHTO H20 loading in traffic areas.
- B. All interior concrete surfaces shall be coated with "Xypex Crystalline" or approved equivalent. Use of a water-resistant admix is acceptable, at Contractor option.
- C. Frames and Covers: As indicated and in accordance with Caltrans Standard Specification Section 75-2.02B. Manhole covers shall have the words "STORM DRAIN" in letters not less than 2 inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.
- D. Frames and lids for manholes shall be match-marked in pairs before delivery to the job site. The lids shall fit into their frames without rocking.
- E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Plans. Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.
- F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of Caltrans Standard Specifications Section 90 and as herein specified. The concrete shall be Class "A" containing six (6) sacks of portland cement per cubic yard of concrete. The grading of the combined aggregate shall conform with the CDT requirements of the three-quarter inch maximum. The consistency of the fresh aggregate shall be such that the slump does not exceed four inches, as determined by ASTM

C143. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.

- G. Steps: ASTM C478 or AASHTO M199. Manufacture from deformed, ½ inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Acceptable manufacturer is Hanson Concrete Products, or approved equal.

2.08 JOINT SEALANT FOR PRECAST STRUCTURES AND MANHOLES

- A. Mortar: Caltrans Standard Specification Section 51-1.02F
 - 1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.
- B. Gaskets: Preformed flexible rubber or plastic gasket
 - 1. Rubber Gaskets: ASTM C443
 - 2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is "Ram-Nek," as manufactured by Henry Company, or approved equal.

2.09 PIPE TO STRUCTURE CONNECTOR/SEAL

- A. A flexible pipe to manhole connector shall be used for all pipe penetrations to pre-cast and/or cast-in-place concrete structures.
 - 1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.
 - 2. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C923.
 - 3. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.
 - 4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

PART 3 - EXECUTION

3.01 PIPE INSTALLATION

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe, Caltrans Standard Specification Section 65-2.03 for reinforced concrete pipe, Caltrans Standard Specification Section 66-1.03 for corrugated metal pipe, and chapter 11.3.3 of AWWA M41 for cast iron and ductile iron pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill

- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with the manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.
- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance at the end of each day's work or when work is not in progress.

3.02 SPECIAL PIPE COUPLINGS

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Manufacturers' instructions

3.03 INSTALLATION OF CURB INLETS, CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC. AND MANHOLES

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
 - 1. Shape bottoms to convey flows as indicated.
- C. Precast Structures: Install as indicated.
 - 1. Seal all joints and pipe entrances and exits.
 - 2. Place concrete in bottom and shape to convey flows as indicated.

3.04 POLYMER-CONCRETE TRENCH DRAIN INSTALLATION

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 21 00, Utility Trenching and Backfill
- B. Install: As indicated and in accordance with the manufacturer's instructions.

3.05 SLOPE PROTECTION PLACEMENT

- A. Rock Slope Protection: Caltrans Standard Specification Section 72-2.03 and as indicated.
 - 1. Use Method B Placement unless otherwise indicated.
- B. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-5.03
- C. Concreted-Rock Slope Protection: Caltrans Standard Specification Section 72-3.03
 - 1. Use Method B Placement unless otherwise indicated.
- D. Sacked Concrete Slope Protection
 - 1. Detailed configuration: As indicated
 - 2. Use one cubic foot of concrete per sack.
 - 3. Locate headers and stretchers as indicated.
 - 4. Headers: Folded end to bank
 - 5. Stretchers: Folded ends are not to be adjacent.
 - 6. Place no more than four vertical courses until initial set has taken place in first course.

3.06 CONCRETE/SHOTCRETE DITCH LINING PLACEMENT

- A. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-5.03

3.07 POURED-IN-PLACE CONCRETE

- A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of Caltrans Standard Specifications.
- B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the Caltrans Standards Specifications. Unless otherwise noted herein or in the Plans, exposed surfaces of structures shall be Class 1 surface finish.
- C. Curing shall conform to applicable portions in Section 90 of Caltrans Standard Specifications. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.
- D. Concrete shall not be cropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

3.08 PIPELINE FLUSHING

- A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning.

3.09 DEFLECTION TESTING

- A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.

- B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.
- C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.
- D. Pull-Through Device:
 - 1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
 - a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.
 - b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
 - 2. Ball, cylinder, or circular sections shall conform to the following:
 - a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
 - b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
 - c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
 - d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
 - 3. Pull-Through Device:
 - a. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
 - b. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.
- E. Deflection measuring Device:
 - 1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
 - 2. Obtain approval of deflection measuring device prior to use.
- F. Deflection Measuring Device Procedure:
 - 1. Measure deflections through each run of installed pipe.
 - 2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
 - 3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.
- G. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

3.10 CLEANING

- A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

3.11 TELEVISION INSPECTION

- A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the drain line shall be televised with a color closed-circuit television with tilt-head camera recorded in DVD format. The original disc and log sheets shall be provided to the Owner for review.
- B. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
 - 1. Low spot (1 inch or greater - mainlines only)
 - 2. Joint separations (3/4 inch or greater opening between pipe sections)
 - 3. Cocked joints present in straight runs or on the wrong side of pipe curves.
 - 4. Chips in pipe ends
 - 5. Cracked or damaged pipe
 - 6. Dropped joints
 - 7. Infiltration
 - 8. Debris or other foreign objects
 - 9. Other obvious deficiencies
 - 10. Irregular condition without logical explanation

END OF SECTION

SECTION 33 46 00**SUBDRAINAGE****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Subdrains in trenches and subdrains or prefabricated composite drainage panels at walls or foundations
- B. Bioretention and biofiltration areas for storm water treatment

1.02 RELATED SECTIONS

- A. Section 31 23 33, Utility Trenching and Backfill
- B. Section 33 41 00, Storm Utility Drainage Piping

1.03 RELATED DOCUMENTS

- A. AASHTO
 - 1. M288: Standard Specification for Geotextiles Used for Subsurface Drainage Purposes
- B. ASTM
 - 1. C1173: Standard Specification for Flexible Transition Couplings for Underground Piping Systems
 - 2. D448: Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - 3. D1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics
 - 4. D1785: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - 5. D2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
 - 6. D2564: Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
 - 7. D2729: Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 8. D3034: Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 9. D4716: Standard Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
 - 10. F477: Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - 11. F656: Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
 - 12. F1336: Standard Specification for Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings
- C. Caltrans Standard Specifications, 2023
 - 1. Section 68-Subsurface Drains
 - 2. Section 96-Geosynthetics

1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials
- B. ASTM: American Society for Testing and Materials

- C. PVC: Polyvinyl Chloride

1.05 SUBMITTALS

- A. Follow submittal procedure in accordance with Section 01 10 00, Supplemental General Requirements.
- B. Product data for the following:
 - 1. Perforated pipe and fittings
 - 2. Solid pipe and fittings
 - 3. Prefabricated composite drainage panels
 - 4. Geotextile fabrics
 - 5. Cleanout plugs or caps
 - 6. Precast clean out boxes and box covers
 - 7. Drainage bubblers
 - 8. Biofiltration soil material
- C. Samples:
 - 1. Drainage Fill

1.06 DELIVERY, STORAGE AND HANDLING

- A. Do not store plastic structures, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe-fittings, and seals from dirt and damage.
- C. Protect permeable material from contamination by other materials.

PART 2 - PRODUCTS

2.01 PERFORATED WALL AND SOLID WALL PIPE

- A. PVC pipe and Fittings Smaller than 4-inch:
 - 1. Pipe: ASTM D1785, Schedule 40. Solvent cement joints
 - 2. Solvent Cement: ASTM D2564. Include primer according to ASTM F656.
 - 3. Perforation Size, Location, and Spacing: ASTM D2729
- B. PVC Pipe and Fittings 4-inch through 15-inch:
 - 1. Pipe: ASTM D3034, SDR 26. Bell and spigot joints
 - 2. Perforation Size, Location, and Spacing: ASTM D2729
 - 3. Fittings: ASTM F1336
 - 4. Joint Gasket: Elastomeric seal, ASTM F477

2.02 SPECIAL PIPE COUPLINGS

- A. Description: ASTM C1173. Rubber or elastomeric sleeve and stainless steel band assembly fabricated to match outside diameters of pipes to be joined.

2.03 CLEANOUTS

- A. Piping: Same as subdrain pipe without perforations.
- B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.

1. Size box to provide access and allow easy removal and reinstallation of plug or cap.
2. Types:
 - a. Non-Traffic Areas: Portland cement concrete box and box cover, light duty.
 - b. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading.
- C. Cover Markings: "STORM DRAIN" unless otherwise specified.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - a. Associated Concrete Products, Inc.,
 - b. Brooks Products Inc.,
 - c. Christy Concrete Products, Inc., or approved equal

2.04 PREFABRICATED COMPOSITE DRAINAGE PANELS

- A. Description: Prefabricated composite panels, 36 to 60 inches wide and manufactured with geotextile facing laminated to molded drainage core
- B. Drainage Core: Three-dimensional, non-biodegradable, molded Polypropylene or Polystyrene
 1. Minimum Compressive Strength: 10,000-lbf./sq. ft. when tested according to ASTM D1621
 2. Minimum Flow Rate: 2.8 gpm per foot at hydraulic gradient of 0.05 and compressive stress of 25 psig when tested according to ASTM D4716
- C. Geotextile: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M288
 1. Survivability Class: 1
 2. Apparent Opening Size: No. 70 sieve maximum
 3. Permittivity: 0.5 per second, minimum
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 1. American Wick Drain Corporation
 2. Tencate Geosynthetics/Mirafi Inc.
 3. Multi-Flow (Prinsburg, MN) (Tel. 800-978-8007)
 4. Phillips Fibers Corporation, or approved equal

2.05 BIORETENTION OR BIOFILTRATION TREATMENT SOIL

- A. Soil specification shall meet requirements of local agency having authority or sustainability requirements for projects achieving environmental goals.
 1. For projects located within the jurisdiction of the Municipal Regional Stormwater Permit (MRP), treatment soil shall conform to requirements in Appendix L of the MRP. Contractor shall provide submittal information verifying conformance to MRP standard.

2.06 DRAINAGE FILL MATERIAL

- A. Permeable Material: Conform to Section 68-2.02F(3) of Caltrans Standard Specifications, Class 2.

- B. Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Sieve No. 57, with 100 percent passing 1-1/2-inch sieve and not more than 5 percent passing No. 8 sieve

2.07 GEOSYNTHETICS

- A. When required, use filter fabric for encasing permeable material around subdrains.
 - 1. Caltrans Filter Fabric: Section 96-1.02B of Caltrans Standard Specifications,
 - 2. Mirafi 140N (by Tencate Geosynthetics/Mirafi Inc.), or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. Install only after unsatisfactory conditions have been corrected.

3.02 PIPING APPLICATIONS

- A. Refer to Plans for location, size, and material designation for individual subdrains.

3.03 INSTALLATION OF PERFORATED PORTIONS OF SUBDRAINS

- A. Excavation: Section 6 of ASTM D2321 and as indicated.
- B. Subdrain Bedding: Place supporting layer of drainage fill over compacted subgrade to compacted depth indicated. If drainage fill requires encasement in filter fabric, lay filter fabric in trench and overlap trench sides before installing drainage fill.
- C. Piping Installation: Install pipe in accordance with Section 7 of ASTM D2321. Install piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert. Excavate recesses for bottoms of bell ends of pipe. Lay pipe with bells facing upslope and with spigot end centered fully into adjacent bell. Bed piping with full pipe bearing in drainage fill material. Lay perforated pipe with perforations down. Install gaskets, seals, sleeves, and couplings in accordance with manufacturers written instructions. Use increasers, reducers, and couplings made for different sizes of materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- D. Initial Subdrain Backfill: After installing drainage piping, add drainage fill up to top of pipe to perform tests.
- E. Testing Subdrain: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling with drainage fill. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- F. Subsequent Subdrain Backfill: After satisfactory testing, cover piping with drainage fill to width and height indicated. Place drainage fill in layers not exceeding 3 inches in loose depth; compact each layer placed. If filter fabric is required complete the filter fabric encasement by bringing fabric to top and closing the encasement.

- G. Fill to Grade: Place native fill material over compacted drainage fill to thickness indicated. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish elevations.

3.04 INSTALLATION OF NON-PERFORATED PORTIONS OF SUBDRAINS

- A. Conform to Sections 31 23 33, Utility Trenching and Backfill and 33 41 00, Storm Utility Drainage Pipe.

3.05 INSTALLATION OF RAIN GARDENS, BIORETENTION OR BIOFILTRATION TREATMENT AREAS

- A. The Contractor shall excavate rain gardens / treatment areas to the elevations and dimensions specified on the plans. Level surface of area of top of treatment soil shown on the plans shall govern actual length and width dimensions if shown on the plans. In-situ soils shall not be further compacted.
- B. Direct the use of heavy equipment and construction traffic around rain gardens so as to avoid compaction, to the extent possible.
- C. After initial site grading, the Contractor shall provide temporary protection from curb cuts and other potential inflow entrances so that runoff drainage does not enter the rain gardens during construction and installation.
 - 1. Treatment areas / rain gardens may be used as sediment settling facilities during mass excavation and commensurate construction activities.
 - 2. Prior to commencing work in rain gardens, the Contractor shall remove and properly dispose of all accumulated sediments.
- D. Excavated soils shall be placed with stockpiled fill and properly disposed and stabilized by the Contractor.
- E. Subdrain installation:
 - 1. Subdrain shall be installed as indicated on the plans at an elevation within the drain rock layer shown on the construction details and connected to the overflow or outfall structure at the invert elevation shown on the plans.
 - 2. For connections of the perforated drain pipes to storm drainage structures, appropriately sized holes shall be cut in the structures at the correct invert elevation specified by the Project Designer or authorized representative. The connections shall be sealed sediment-tight and secured in place with mortar or other approved joint sealant compatible with subdrain pipe materials.
 - 3. Drain rock layer shall be approved Class II Permeable Material. Crushed rock or aggregate base cannot be used within the treatment area, in, around or under the drain rock layer.
 - 4. Care shall be exercised to prevent natural or fill soils from intermixing with the drain rock surrounding the underdrain. All contaminated drain rock shall be removed and replaced with uncontaminated Class II permeable material.
 - 5. Attach subdrain piping to overflow structure.
 - 6. Install cleanouts at the ends of the subdrains. Install screw-on end caps set flush with the finished top of treatment soil.
- F. Overflow drain structure:
 - 1. Install overflow structure at the elevation and location specified on the plans. Attach subdrain piping to overflow structure. Attach solid pipe from overflow structure outfall storm drain system at elevation and slope indicated on the plans.

2. Rim elevation of overflow structure must be set above the elevation of the top of treatment soil by the amount indicated on the plans, typically 6 inches. Contractor shall verify that the rim elevation of the overflow structure is also a minimum of 2 inches below the lowest elevation of the treatment area perimeter so that storm flows will reach the overflow rim before the top of the treatment area perimeter.
 3. The overflow structure shall have an open bottom filled with drain rock if indicated on the plans. This should be installed where the overflow structure has a sump condition (subdrains lower than the outfall invert elevation). The overflow structure shall be installed such that the bottom of the structure is set a minimum of 6-inches below the undisturbed bottom of the treatment area. Drain rock in the overflow sump shall be installed up to the invert of the lowest pipe connected to the structure.
- G. Filter media soil backfill
1. Filter soil of the approved specification shall be installed to the elevation indicated on the plans. Care should be taken to ensure that the soil is not compacted and that no equipment is driven on the backfill. Walking on the backfill should be limited to what is absolutely necessary.
- H. Planting soil, plantings, and mulch shall be installed per the plans. Non-floating bark / mulch shall be used, if indicated, to prevent removal of material and clogging of the overflow.
- I. Testing of the treatment area should be conducted once the filter media is installed and all storm drain piping is connected. The area should allow an infiltration rate well above 5 inches/ hour to ensure that the treatment area will continue to function at 5 inches/ hour over the lifetime of the treatment area.

3.06 PREFABRICATED COMPOSITE DRAINAGE PANELS

- A. Coordinate placement with other drainage materials.
- B. Install prefabricated drainage panels in accordance with manufacturer's instructions.
- C. Place perforated drainage pipe at base of footing and attach to composite drainage panels in accordance with the manufacturer's instructions.

3.07 JOINING PIPE

- A. Join PVC pipe and fittings with elastomeric seals according to ASTM D2321 or solvent cement.
- B. Special pipe couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

3.08 CLEANOUT INSTALLATION

- A. Cleanout piping to be the same size as the subdrain piping to which it is attached.
- B. Install cleanouts from subdrainage piping to grade. Locate cleanouts at beginning of piping run, at changes in direction, and other locations indicated.
- C. Do not allow cleanout box to bear on cleanout riser.

3.09 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

3.10 RETAINING WALL DRAINAGE

- A. Unless otherwise specified, drain system should consist of a minimum of 12 inches thick free-draining granular materials containing less than five percent fines passing a No. 200 sieve placed adjacent to the wall. Free-draining granular material should be graded to prevent the intrusion of fines or encapsulated in a suitable filter fabric. As an alternative, a prefabricated drainage structure, such as geo-composite, or approved equivalent, may be used as a substitute for the granular backfill adjacent to the wall.
- B. Drainage system consisting of either weep holes or perforated drain lines (minimum 4 inch diameter placed near the base of the wall) should be used to intercept and discharge water which would tend to saturate the backfill. Where used, drain lines should be embedded in a uniformly graded filter material and provided with adequate clean-outs for periodic maintenance.
- C. An impervious soil should be used in the upper one foot layer of backfill to reduce the potential for water infiltration.

END OF SECTION

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